May/June 1981

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I/O News

Volume One, Number Five

MAPPING ROUTINE FOR FLOPPY DISK CLUSTERS

MESSAGE UTILITY

INTERNATIONAL GROUP TREASURY SYSTEM

The OFFICIAL PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF CROMEMCO USERS

Cromemco Introduces First of New MASTER Series Software

Cromemco's latest software release has been written around the principle that simplicity is beauty. WRITEMASTER, the first of a new 'Master Series' of software to be released, is aimed at computerists and non-computerists alike.

WRITEMASTER is a word processing package designed to allow secretaries, typists, writers and others without previous computer experience to enjoy full use after only a few minutes of instruction.

And, the checks and balances required for users are built-in through the utilization of terminal screen showing exactly what has been inputted.

Much of the simplicity of WRITEMASTER has been accomplished by the elimination of the need to learn a new vocabulary. The package allows some 40 functions, and these are all in plain English. (See list below in this article.)

The commands, too, are in plain English and only require the user to have a basic idea of what he wants to do. Many of the commands are activated with a single stroke.

Further, WRITEMASTER contains a marvelous 'HELP' function which brings up the complete menu of functions and commands, obviating the need to rely on the user's memory.

It should be noted that WRITEMASTER was written to take total advantage of the functions inherent in the Cromemco 3102 Terminal. This is a powerful terminal, and WRITEMASTER — as well as other software in Cromemco's new Master Series — is dependent on that power. Special functions are aided through the use of a

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Polynomial Interpolation

By Jerome J. Tiemann

I INTRODUCTION

There are many times when we marvel at the abilities of computers. These are times when the computer accomplishes tasks that humans find difficult or tedious. On the other hand, there are times when the computer balks at tasks that are easy for humans to accomplish. For example, suppose we have a collection of data points and we ask the computer to plot them on a graphics screen. No problem—Bingo! There they are on the screen! But, what if we ask the computer to draw a smooth curve through them? A human can easily do this (given a French curve or an artistic hand). How can the computer fill in the blank spaces between

Continued on page 16

CDOS Remote Console Routine for the D.C. Hayes Micromodem-100™

By Robert J. Diersing

During the past two years there have been several S-100 bus modem cards placed on the market. With the proper interface to the operating system, these devices can add another dimension to the microcomputer system.

Here are some of the uses that I have found for access to a Cromemco computer system via dial-up telephone line. Frequently, I find it necessary to demonstrate some program that I have written and that demonstration may be a considerable distance from my

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I/O News The Official Publication of The International Association of Cromemco Users is available through membership in the association. Editorial and advertising policies are designed for the enlightenment of the members in regard to new uses for, and developments of, Cromemco products and other products compatible with Cromemco systems.

COVER FEATURES

ARTICLES & FEATURES

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Richard Kaye
Editor and Publisher

Lynn Platzek
Editorial Assistant

input . . .

Editor
I/O News

Thanks for the three back issues of I/O News you sent to initiate my subscription. Good stuff too—glad I subscribed.

Allow me to make some observations while they are fresh on my mind, even though I've just stepped through the door. The publication's stated goal (index page) is a worthy one, granted. But as an "association or users" I think I expected something additional in the area of critical review and analysis. Now, I appreciate the desire not to develop an adversary relationship with Cromemco—that's good. Please do your best to maintain it. However, couldn't we develop a balanced relationship with Cromemco in which there is the freedom to talk about the shortcomings and limitations of our systems? For in so doing we can begin to find solutions for them and/or be prepared to cope with them. Perhaps on down the road you're planning to ease into more critical areas? I hope so, because then you'll start meeting us down where some of our heavy problems exist. The overwhelming impact should continue to be positive, and will be naturally, due to the quality of the product. But I think the promotional value is actually enhanced when the reader is helped to understand the shortcomings and limitations of the equipment/software he's purchasing.

My expectations for I/O News also include the following:
—that this be a place where software/hardware bugs, when discovered, can be discussed, documented, and eliminated.
—that this be a springboard or stimulus for future development of hardware/software, where the users in the field have a platform from which to discuss and influence the directions toward which the hardware they've purchased is moving.

For example:
—Any plans for a PL/1 implementation? I'd like to see it. Meanwhile, anybody know how well PL/1-80 will run under CDOS?
—I'd like to see a companion native code compiler to Cromemco Basic. Anybody else feel the same way? I like 16 K Basic, but once my programs are debugged, I sure could use the extra speed performance.
—Any plans to add a 50 Meg drive? How come other systems can do it cheaply?
—I have problems believing that Cromemco's multiuser system (CROMIX) can cut it, especially with one CPU, in a real world environment. On this issue I've got an open letter to Cromemco in the works, which I will include for your use, perusal and feedback. If I'm out to lunch on this, let me know, and send it back (return postage included).

Enough for now. Keep up the good work...but go for a little less "gloss" and a few more pages.
Respectfully,
John D. Hurni
Project Engineer
Radio Southeast Alaska

John, you've made some good points, which will be addressed in order. Your letter was written before you received the March/April issue. That was the first issue which carried what is proving to be a very popular column, TEC TIPS. We too, envision this column as a place to discuss hardware/software bugs. The "bits & bytes..." section is also available as a forum.

We agree with you that this group can be an ideal platform for influencing the direction and development of new software/hardware. All we can say is that the people at Cromemco read each issue of I/O News from cover-to-cover. If enough members show an interest in any given product, I am certain Cromemco would be influenced. On some of your specific points:
—We, too, would like to know the interest level of members in PL/1-80, and whether it will run under CDOS. Any hands-on experience out there?
—Try 32K Structured BASIC. This has been consistently rated by independent experts as the best BASIC anywhere.
—Will a 40 meg. hard disk do for now? See "output..." Volume One, Number Four.
—Your comments on CROMIX, and the letter you sent to Cromemco (thanks for the copy), were interesting. I have been advised that what you actually described was a form of networking. By now, you may have received a reply from Cromemco indicating that networking devices will be forthcoming. I cannot say when, but it is my guess that we are less than one year away from all the devices necessary to effect an excellent communications system with our Cromemcos.

John, how about a compromise on your last point? Why not keep the "gloss" AND have more pages? As you know, we are dependent on members for articles and features. And, we have been receiving some excellent ones. Now, here's where you, and a lot of other members, can help. Let us know how and for what you are using your systems. Nothing makes for more interesting reading than the actual, pragmatic applications of computers in the marketplace. In fact, you might consider sending us the story of what you are doing with your system. It could be fascinating, and will certainly add to our pages.

Thank you for your letter.

Ed.

Editor:

Yes, indeed!!! I enjoyed very much the first copies of I/O News. Finally there is a magazine of support to the Cromemco user community. I only have one complaint. I wish it had started a long time ago!!!

I am very happy that this magazine came up to life in such a beautiful and magnificent way. The Cromemco user community in Mexico (and believe me, we are a fast-growing bunch) was expecting something like this for a long time.

Most of us were subscribers to Mr. Dave Dameron's CUssP (Cromemco User, systems and software Pool) and were delighted with the articles, hints, programs, special routines, etc. And now we have you. Boy, what a thrill!!!

It was a good thing to have the story on Cromemco, as most of us had heard it from rumors and third parties. Finally we can explain to our customers what the name Cromemco means.

Our company has been in the microcomputer market since 1977. We installed the first Cromemco System III in Monterrey, N.L. She is running with 277 drives, 16KZ boards for a total of 64K RAM, a 3101 CRT and a 3703 line printer, and works like a dream. We haven't had a real serious malfunction with her or any major replacement at all. Sometimes, she runs 10 to 12 hours a day (right now, we have had it in Multi-User with 2 users constantly logged on). On Saturdays and Sundays, we leave her with memory board tests, disk diag tests, ZPU tests, etc. She's working like a real champ!!!

Well, now that I read back, I noticed that it has been a long letter. I better quit before somebody hits the ESC key, or better yet, turns the RESET

Continued on next page

Reminder...

Most one-year memberships expire August 31, 1981. Now you may use your VISA or MasterCard to renew your membership without missing an issue of I/O News. Simply complete the form below and mail to:

The IACU
P.O. Box 17658 • Irvine, California 92713 • U.S.A.

Membership No. _____

Please renew my Membership in the International Association of Cromemco Users right away. I have enclosed my ☐ Check ☐ Money Order in the amount of

$ _____ for a _____ year membership.
(U.S. Dollars drawn on U.S. Banks only please)

Membership Rates in the United States
( ) 1 yr. = $35.00
( ) 2 yr. = $65.00
( ) 3 yr. = $90.00

Membership Rates in Canada and Mexico:
( ) 1 yr. = $41.00
( ) 2 yr. = $77.00
( ) 3 yr. = $108.00

Membership Rates in all other countries:
( ) 1 yr. = $48.00
( ) 2 yr. = $81.00
( ) 3 yr. = $129.00

Now available in the U.S. and most other countries on your VISA or MasterCard (please type or print clearly)

( ) VISA/MasterCard _____
(Expiration Date)

_____
(Your Full VISA or MasterCard Number)

Date _____ Signature _____

_____
(Name exactly as it appears on card)

A special thanks to all Charter Members for their support during our first year. Next year promises to be even better.

input . . .

Continued from page 5

key.

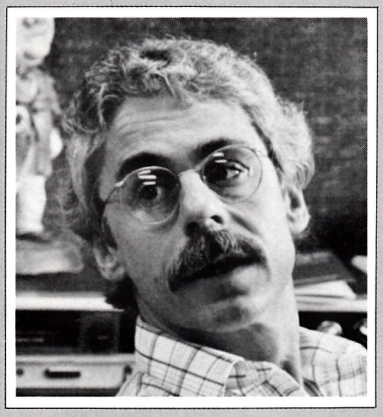
I hope you didn't get bored and that you enjoyed reading this letter as much as I enjoyed writing it. (I apologise for any orthographic fault in my not-so-very-good English.)

Keep up the good work at I/O News, and congratulations to you and your staff from all of us at Soporte.

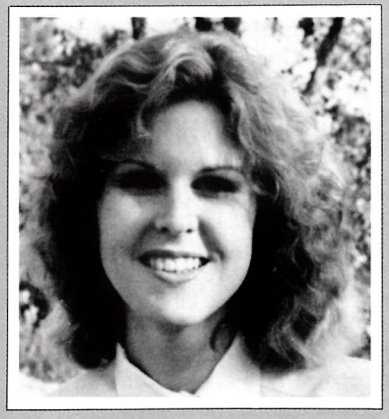
Looking forward to hear from you.
Raul Davila
Ingenieria De Sistemas
PS: Congratulations, also to Mr. Darwin A. Engwer of Dynamic Systems Group for his fine article and his very helpful application. We are already using it on our A/R software (single user and multi-user) as a back-up option. It works fine, the user doesn't have to mess up with XFER or any fast copy utilities, and we save us a day's worth of trying to recover erased files. Congratulations again to him for a marvelous job.

(Editor's note: If enthusiasm is the main ingredient in selling computers, it is no wonder Soporte is such a successful dealership.)

output...



RICHARD KAYE



LYNN PLATZEK

Almost Renewal Time

Can you believe it? On August 31, we will have completed our first publication year. And what a year it has been! Your support and encouragement — and especially your articles — have made this year even more successful than we dared hope. And, you will be pleased to know that we are growing at better than our anticipated rate. With growth comes new ideas — new insights into computers — and new viewpoints to air on the pages of I/O News. They say that the first year in any new venture is the most important year. Thanks to you — our Charter Members — this year has been totally rewarding. For those of you looking for a renewal form, one is printed on page 6. We hope to see all of you aboard for many years to come.

A Note From Lynn

We have already sent out 75% of the binders to Charter Members, and are catching up at the rate of 80-100 per week (except deadline weeks). This means that by August we will be completely caught up. Thanks for your patience.

It would save us a lot of time — and you a lot of toll charges — if you could have your Member Number available when you call. It would also help me a lot if you included it with any correspondence.

Also, do let me know of any address changes. Most of you have been almost religious about this, but I do have a few returned copies with nowhere to send them. Thank you for your help.

Treasure Chest Opened

Perhaps the biggest news to appear on this page is the uncovering of some 2,700 programs — all in the Public Domain. We are researching the validity and accuracy of these packages now, and will issue a full report on what we find. Hopefully, this information will be ready for our July/August issue. If this software is what it is reported to be, it will open the treasure chest to us all. Stay tuned.

Information Master

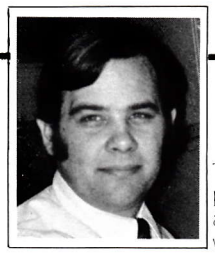
In the "bits & bytes..." section of Vol. I, No. 4, we noted a recommendation from Professor Runnels about "Information Master," an information storage and retrieval package. We gave Big Willy (our resident software expert) a copy of the program at the same time as the abstracts on the Public Domain software (mentioned above) arrived. Big Willy's conclusion was that "Information Master" could be an ideal archiving and indexing package to keep track of all these programs. We'll keep you posted.

Keep Those Articles and Features Coming

One of the reasons this magazine is apparently so closely read is that the articles submitted by members have been so well prepared, and expressed so much of their personal experiences with their systems. Certainly these experiences are what other users like to explore and can relate to. Please remember that you do not have to be a professional writer to have your practical applications, problems and solutions, or ideas printed in this magazine. Believe me, other users really do want to know what you are doing with your computer. We will all be enriched if each of you can share something with the rest of us.

Thank you for your participation.

tec·tips



TEC TIPS is a regular column aimed at providing hints for keeping systems up and running. It will not attempt to deal with specific engineering applications or non-standard configurations. TEC TIPS is edited by Richard Quinn, owner of QUINTEC, a Southern California Computer service firm.

HARD DISK WARM UP

Many users of the Z-2H, HDD-11, or the HDD-22 have experienced data reliability problems with data that has been written to the disk shortly after power up. This could be because the read/write heads change angles as they warm up and expand. The heads are mounted on an extremely thin, flexible piece of spring steel. As this steel warms the angle of the head may change slightly causing slightly different track alingment. To insure that data written during the first few minutes of operation is reliable, it is recommended that no writing be done to the hard disk for the first 15 to 20 minutes of operation. Thereafter, the disk should be warm and data written should be accurate. Notice that this only applies to disk writes, and not disk reads.

16FDC CRAMPED FOR SPACE

From Bob Lowes in Newport Beach, California, we get the following recommendation: Upon installing the newer 16FDC in his Z-2H system, he experienced intermittent system crashes. Upon closer examination he discovered that the 5-inch floppy disk connector, J2 on the 16FDC, was causing the board to bow and come in contact with the face of the board next to it. In Bob's case, the board next to it was the 64KZ with its large metal heat sink. When the 16FDC solder side of the board came in contact with this heat sink, the system would shut down. Bob solved his problem by rearranging the cards and by placing pieces of plastic mylar over the solder side of the board.

64KZ IN HOT SYSTEMS

Many have experienced reliability problems with the 64KZ memory card. This is especially true in systems using large amounts of memory such as the SDI-Graphics or multi-user Cromix systems. The problems usually show up as "Invalid jump to location XXXX" under CDOS or "All memory in use" under CROMIX. At times the system simply "locks-up" and has to be reset, or dies when running a program. The problem is heat. Be certain the bus voltage is correct (I/O Tec Tips, March/April 1981), all vents are clear and clean, and the fan is operating properly.

If all of these things seem fine, replace the bus interface chips, IC76 and IC77, a 74LS374N and IC78, a 74S373N with the following: IC76 and IC77 — 74S374J or 54S374J; IC78 — 74S373J or 54S373J. These are heavy duty IC's that will take the heat better and have solved many problems in the systems I service.

As a final measure, adding a larger fan as suggested by Bill (I/O News, March/April 1981, Bits & Bytes) is very helpful. This is especially true for Z-2H's, and I would recommend larger fans for any Cromix system with two or more users.

USING RDOS DIAGNOSTICS

Some may not realize how useful the 16FDC self-test diagnostics are in problem solving. You are referred to the 16FDC manual under the chapter entitled, "RDOS II". Many of the memory test features and disk read/write tests are useful in quickly determining whether or not a system is basically functioning properly or not. There is one problem, however, with the RDOS manual. One of the features of RDOS is the side select command. When using either Persci 299 drives or the Tandon drives, it is often useful to use the side select command, reading first one side and then the other side of a double-sided floppy disk to determine whether a problem exists with one head or the other on the drive. The set disk drive command is given as SX (side Ø or 1) [CR].

When I tried to use this feature, the computer would not take the SX command. Guessing that the typist preparing the manual might just have made a "type", I checked other keys in the vicinity and found that the command really should be SC (side Ø or 1) [CR]. This feature is especially useful for those aligning disk drives when used in conjunction with the alignment on/off command (A).

CHECKING RIBBON CABLES

If you suspect you have a ribbon cable malfunction there is a fairly simple way to test the cables provided you have a simple continuity checker such as a volt/ohm meter or low voltage, low current test lamp. This is especially useful in checking cables on the HDD memory system to ensure that the double set of connector cables is hooked up correctly. While this procedure will work for any ribbon cable, I will use as an example the HDD cable. Pulling the cable off of the WDI board and the hard disk drive, you will notice the red marker cable on one side of the ribbon. Insert a small diameter paper clip or other small diameter conductor into pin no. 1 (adjacent to the red marker) on each connector. Checking for continuity between the two pins will indicate whether or not there is continuity between the pins. Then, while holding the tester on one end of the cable, check on the opposite connector for shorts between adjacent pins on each side of the one being tested, as well as pins across from the tested pin. Following a clockwise circular pattern, testing for short on each pin should tell you whether or not the ribbon cable is connected correctly, or if any internal shorts or opens have occurred. After checking pin one for shorts and opens, move on to pin two and so forth until all pins have been tested.

If some of the tips helped you, write and tell us. Calls made to QUINTEC for help will be returned collect. With the many requests for help, our phone bill gets out of hand.

Cromemco Introduces First of New MASTER Series Software

Continued from page 1

template which fits over the Special Function keys of the terminal. (See photo.)

Following is a summary of some of the duties WRITEMASTER can help you perform.

WHAT YOU CAN DO

WRITEMASTER lets you type as you would on a typewriter such things as letters, documents, tables or charts, memos and most any other desired material.

You can set margins, spacing, tabs, automatically number the pages, use headings, and vary page length and indention.

Having typed the material, you can:

1 — correct spelling
2 — correct punctuation
3 — move text
4 — copy text
5 — underline words
6 — boldface words
7 — delete characters, words, whole pieces of text or an entire file
8 — insert characters, words, whole pieces of text, or one file into another
9 — merge two files
10 — print your file with letter-quality printing
11 — find and/or replace characters, words, or phrases
12 — save the file for later use
13 — re-enter any file to re-edit, print or read
14 — format your file on the screen exactly how you want it printed

By now you can see that WRITEMASTER has much of the power of the often very expensive dedicated word processors and yet this is accomplished with Cromemco's general-purpose computer (with terminal and printer). In fact, the power and sophistication of the Cromemco 3102 terminal are important in achieving what is nearly the capability of a dedicated word processing system.

The power of WRITEMASTER is well shown by the following description of its commands and functions for various tasks.

In text formatting, you have commands for alignment of left margin of all or any part of the text you wish; left and right justification or text with optional incremental (normalized??) spacing; automatic word wrap, automatic page boundary display; variable line spacing; page numbering and heading insertion.

You would also have function keys for single key alignment and left and right justification; and line centering.

When editing text, you have commands for extensive find and replace operations including general category and user-specified category search; variable speed file scanning; complete set of jump to commands including jump to a given page; temporary storage and movement of text through disk storage (text trucks); block text delete; block text insertion from disk files; and block storage of text sections to disk.

Editing function keys include those for converting letters between upper and lower case; transposing; paragraph definition, moving text, copying text; page termination, delete recovery; moving from character to character, word to word, and page to page; and text "select."

When printing, you have commands for printing of file with incremental word spacing; printing of file; and printing of a given page of text. You have a function key for printing the screen contents.

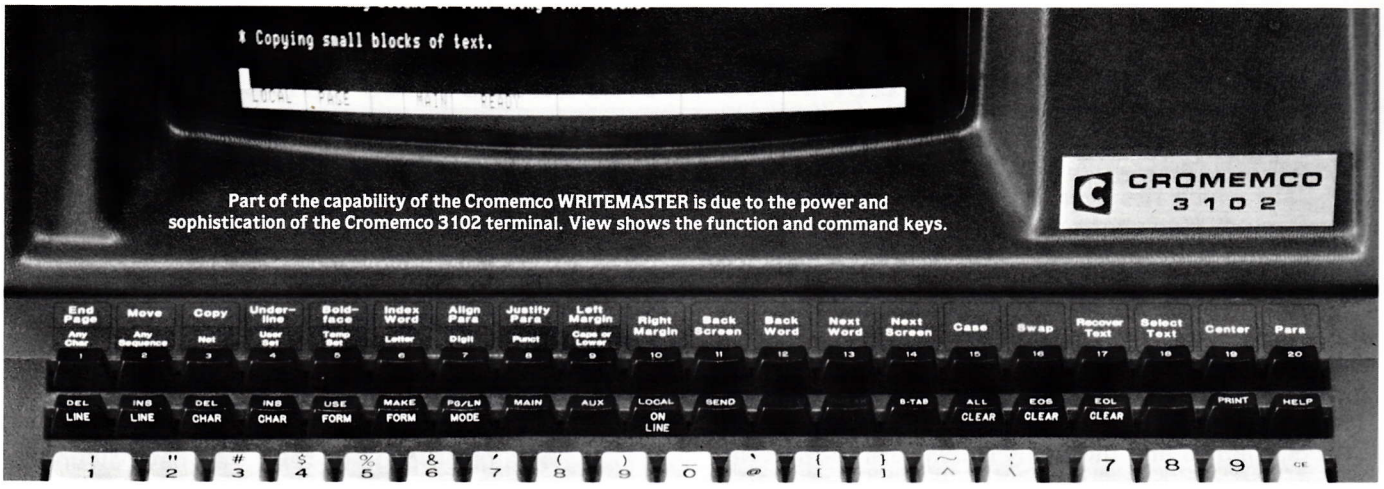
For file maintenance purposes, you have commands for creating new files; editing old files; deleting files; renaming files; aphabetizing an internal directory of editable files; read include; writing a subsection of edit file to disk; perusal of disk files while editing; and accessible single generation of backup files.

Plus all the above you have commands for underlining, boldfacing, index preparation, and mail merge; and function keys for underlining, boldfacing, and indexing.

List and Brief Explanation of Writemaster Commands

WRITEMASTER COMMANDS:
ABORT
WRITEMASTER—Aborts program, returns control to operating system
TEXT—Disposes of current text, returns file to original state before editing session began
ALIGN
ALL—Manipulates all text to fit within currently set left and right margins, indentation, and line spacing.
CURSOR-END—As above for area described
BEGIN-CURSOR—As above for area described
SELECTED-TEXT—As above for area described
BOLDFACE
SELECTED-TEXT—Makes text appear boldface when printed
WORD—As above only words
CREATE—Creates a new blank file with name specified in command
DELETE
BEGIN-CURSOR—Deletes area of text described
CURSOR-END
SELECTED-TEXT
BOLDFACING—Any boldfacing text
UNDERLINING—Any underlining of text
INDEX-TEXT—Any index markers
FILE—The file specified
DIRECTORY—Shows files on currently active disk
DISK—Changes currently active disk
DUMP—Inserts the contents of the specified text truck in edit file
EDIT—Activate an existing file for editing
FIND—Specified text (many options, very powerful)

Continued on next page



Part of the capability of the Cromemco WRITEMASTER is due to the power and sophistication of the Cromemco 3102 terminal. View shows the function and command keys.

Continued from page 9

HELP—To review a summary of operation
INDEX—To build an index from previously marked test
JUMP—To location specified by command name
- BEGINNING
- LAST-LOCATION
- END
- PAGE
- INDEX-ENTRY
- SELECTED-TEXT

JUSTIFY—Same as align only interword spacing is added to make right margin even. Also allows incremental printing of text.
- ALL
- CURSOR-END
- BEGIN-CURSOR
- SELECTED-TEXT

LOAD—Fill a text truck with text preporatory to move or copy of large block of text.
LOCK—Freezes specified text against alignment or justification.
- ALL
- LINES
- BEGIN-CURSOR
- SELECTED-TEXT
- CURSOR-END

MARK—Specified text for inclusion in index, or data record boundary for merge
- SELECTED-TEXT-FOR-INDEX
- MERGE-RECORD
- WORD-FOR-INDEX

MERGE—Merge data from one file with another. Files are specially constructed.
PRINT
FILE—Entire contents of file
PAGE—Page currently being edited
JUSTIFIED—If previously justified text, print with incremental spacing
QUIT—Exit program with option to update text file
READ—Include contents of specified file in edit file
REFORMAT
EXTERNAL—Make Writemaster file into screen file
INTERNAL—Reverse of above
RENAME—A file
REPLACE—Text string with new test, repeats
SAVE—Updated edit file and continue editing, or edit a different file
SET
DISK—Same as disk command
SEARCH-PARAMETERS—Set contents of special search sets, case sensitivity
FORMAT—The parameters used by align etc., such as left and right margin page length.
TABS—Change tab stops, presetable margin stops
SHIFT—Move margins to preset margin stops, direction is command name
- IN
- OUT
- LEFT
- RIGHT
- NORMAL

SHOW—Information indicated in command name
- FILES
- SEARCH-PARAMETERS
- FORMAT
- SELECTED-TEXT
- LOCATION
- TEXT-TRUCKS

TYPE—Displays contents of file or truck on screen
- FILE
- TEXT-TRUCK

UNDERLINE—Same as boldface only for underlining
UNLOCK—Reverse effects of lock command, for area specified in command name
- ALL
- LINES
- BEGIN-CURSOR
- SELECTED-TEXT
- CURSOR-END

WRITE—Create a new file and file with excerpt from edit file

List of Writemaster Function Keys

End-Page/Any Char
Move/Any Sequence
Copy/Not
Underline Word/User Set
Boldface Word/Temp Set
Index Word/Letter
Align Paragraph
Justify Paragraph/Punct.
Left Margin Text/Digit
Right Margin
Back Page
RESET
BREAK
B-TAB
ALL CLEAR
EOS CLEAR
EOL CLEAR
PRINT
HELP
DEL LINE
INS LINE
DEL CHAR
USE FORM
MAKE FORM
PG/LN MODE
MAIN
AUX
LOCAL ON LINE
SEND
Back Word
Next Word
Next Page
Case
Reverse Letter XY
Recover Text
Select Marker
Center
Paragraph

WRITEMASTER is available from Cromemco dealers everywhere on either 5¼" or 8" diskettes at $595.00, thus making it quite competitive — both in functional design and in price — to any other word processing software.

Message Utility

By Raul Davila

Imagine yourself as Sales Manager of a medium size company. The company has just bought a Cromemco System III with multi-user, and a terminal has been installed in your department.

At last, you'll be able to keep up to date with your customers (and with the Director of the company). In a matter of minutes, you can have a customer account status or aging report or an invoice, etc.

Every morning the operator types in all the information to the system: invoices, updates to the master customer file, date of shipment, etc. And every morning, she (the operator) has to call the computer room people (unfortunately, the computer has been installed in the Production Department, some 100 yards away from her department) to let her log on to the system, to log on the A/R diskettes, etc. Quite annoying, isn't it? There's got to be a better way.

So you contact the company who developed your software. "Is there a way we can communicate between terminals?" "Can we send a message in plain English?" come the first questions over the telephone line. After a good technical explanation (you supposed it was good, 'cause you didn't understand a word!) you get a "we'll see to it" answer. You sit and wait.

"They will do it," you think to yourself. After all, they did a good job with the A/R software, customizing it to your needs.

This example sounds a bit like fiction, but it is a true life story. One that really happened to us [Soporte].

We came up with a good solution to this "communication gap" problem. A gap of more than 100 yards!!! It is not the only solution, as you will see later, but it works. And to that 'medium size company' it was a real lifesaver.

The problem stated plainly is: Can it be possible to send ASCII code ('send a message in plain English') from one CRT to another CRT? The answer is YES. It is possible.

The way we solved it is this:

The TU-ART card has two serial I/O ports and two 8-bit parallel I/O ports.

THE STAFF AT SOPORTE:
From left to right:
JAIME MARTINEZ, Customer Support, Service Engineer
JUAN ANGEL PEREZ, General Manager, Software Engineer
RAUL DAVILA, Software Engineer
OFELIA MONTALVO, Secretary (seated)

When you have multi-user CDOS version 1.52 running on your Cromemco, you need one TU-ART card for every two CRT, if you want the CRT constantly logged-in with the system. (The console or main terminal is plugged to the 4FDC card.)

The CRT plug is the serial ports of the TU-ART, and these ports are accessible by software, so, if we talk in BASIC, you can out a byte to any of those ports. It is that simple.

You can see the listing of the program in Fig. 1. Line 160 assigns the values of the ports to a one-dimension array of the possible users. You enter the number of the destination user at line 280. A RETURN terminates the program. Check the user at line 340. One nice way of doing it would be to check if the user is currently logged on, and if it is not, then send the appropriate error message.

But Cromemco does not supply that much information on system calls, special memory locations, system configuration, etc., about Multi-User CDOS. On the other hand, single-user CDOS and CROMIX are provided with a lot of useful information.

Back to the listing. The message is sent on lines 460-520. It is done one character at a time and displayed on the Status Line of the destination user terminal.

You will have to change the program if you do not have a 3102 CRT. This is very easy. Just change lines 460, 540 and 600-640 for the

Continued on next page

Continued from page 11

similar codes on your terminal.

The reason for sending the message to the Status Line of the 3102 CRT, is that by doing it this way, the message will not mess up any job on the destination user terminal. You wouldn't want to destroy that beautifully formatted invoice entry form on the sales department terminal. Or would you?

In line 580, the program takes some time — 7 to 10 seconds -- enough for the message to be read by the destination user. After the time loop is completed, the message is clear from the Status Line on lines 600-640. The rest is the invalid user subroutine and the error subroutine.

Like I said before, this is not the only solution. It is just one solution. And it is good to have it around. You never know when your terminal will be moved away from the main computer.

The program can easily be converted to FORTRAN, RATFOR, ASSEMBLER or what have you. Remember: your imagination is your limit.

```
   20 Rem  MESSAGE UTILITY PROGRAM
   40 Rem  ALLOWS MESSAGES TO BE SENT BETWEEN USERS
   60 Rem  T A L K - 2 . A S C   version 1.5
   80 Rem  (C) 1980, SOPORTE ADMINISTRATIVO COMPUTACIONAL, S.A.
  100 Rem
  120 On Error Goto 30000
  140 Dim N$(79),M$(40)
  160 P(1)=1 : P(2)=33 : P(3)=81 : P(4)=97 : P(5)=113 : P(6)=129
  180 @Chr$(7);Chr$(27);Chr$(69) : @ : @ : @"MESSAGE UTILITY" : @
  200 @"This program allows messages to be sent between users."
  220 @"The message will be transmitted to the destination"
  240 @"user after each <CR> is depressed. Up to 80 characters per message."
  260 @"To quit now, press RETURN."
  280 @ : @"Number of destination user (1,...,7; CR)?"; : Input" ",U$
  300 If Len(U$)=0 Then Goto 32767
  320 Rem  VALIDATE THE USER
  340 If Val(U$)<1 Or Val(U$)>7 Then Gosub 10000 : Goto 280
  360 U=Val(U$)
  380 @ : @"MESSAGE ? "; : Input"",N$
  400 If Len(N$)=0 Then Goto 32767
  420 L=Len(N$)-1
  440 Rem  SEND MESSAGE TO THE STATUS LINE OF THE SELECTED USER
  460 Out P(U),7 : Out P(U),27 : Out P(U),59
  480  For N2=0 To L
  500  O=Asc(N$(N2,N2)) : Out P(U),O
  520  Next N2
  540 Out P(U),29 : Out P(U),27 : Out P(U),49
  560 Rem  MAKE TIME FOR THE MESSAGE TO BE READ BY THE USER
  580  For I9=1 To 6000 : Next I9
  600 Out P(U),27 : Out P(U),50
  620 Out P(U),27 : Out P(U),59 : Out P(U),29 : Out P(U),27 : Out P(U),49
  640 Out P(U),7
  660 Goto 380
10000 @Chr$(7);"Invalid user...try again." : Return
29990 Rem  INVALID ENTRY SUBROUTINE
30000 E=Sys(3)
30010 If E=202 Then Gosub 10000 : Goto 280
32767 Close : @ : @ : @ : End
```

Fig. 1

About The Author

RAUL DAVILA is Systems Engineer in the Software Development Department of SOPORTE ADMINISTRATIVO COMPUTACIONAL, S.A. in Monterrey, Nueva Laredo, Mexico. The firm is a dealer for many different brands of computers — from personal micros to business minis — as well as peripheral equipment. SOPORTE started as a servicing and consulting company in 1977, and grew into one of the most complete dealerships in Mexico.

Mapping Routines For Floppy Disk Clusters

By Jim Gunkel

Blackboard discussions only go so far with a group, but a program that presents an allocation map can show exactly the way a disk is allocated. It can also help explain why disks should be "cleaned up" occasionally.

Following is a short program that can be used to demonstrate how the allocation procedure works. This is a practical program that could be added to the serious user's library. It also shows how to set up the special CRT calls, and figures out how much of the disk space has been used. Following the program listing are examples of the output. One example shows how scattered the files are, due to long term use without an effort to "clean up" the disk.

Also buried in this discussion, but vividly illustrated, is why programs take longer to load after a period of use on some of the more active floppy disks.

As a personal aside, whenever programming for the professional user I try to make the program versatile first, mathematically efficient second — NOT THE OTHER WAY AROUND. Most users are not as concerned over a one second savings in run time as they are with the program running reliably on their systems.

Further, a program should not need changes as the user upgrades from single-sided to double-sided disks, then up to double-density, and so on up the technological improvement scale. For example, this program uses a dynamic read of the CDOS allocation call to determine the number of disk clusters. This allows the routine to be used on any floppy disk configuration.

With these thoughts in mind, let us proceed to the program.

Continued on next page

```
        TITLE   MAPPING ROUTINE FOR FLOPPY DISK CLUSTERS
        REM
        REM     JIM GUNKEL - FEBRUARY 1981
        REM
        REM     2145 RED ROCK DRIVE
        REM     DAYTON, OHIO 45431
        REM     (513)-426-6999
        REM
;
        EXT     BIND            ;BINARY TO DECIMAL ROUTINE
;
TRUE            EQU     -1
FALSE           EQU     0
;
CROMEMCO        EQU     TRUE    ;DO YOU WANT CLEARSCREEN ON CRT
;
AUXDSK          EQU     04H     ;INPUT/OUTPUT PORT FOR DISK LABELS
;
CDOS            EQU     05H     ;CDOS CALL
   ALLOCATION:  EQU     1BH     ;GET CLUSTER BIT MAP
   CURRENT:     EQU     19H     ;CURRENT DISK DRIVE
   PRINT:       EQU     09H
   RDBLOCK:     EQU     83H     ;READ LOGICAL BLOCK
   SELECT:      EQU     0EH     ;SELECT DISK DRIVE
   SPECIAL:     EQU     8EH     ;SPECIAL CRT FUNCTIONS
;
CR              EQU     0DH     ;CARRIAGE RETURN
FCB1            EQU     5CH     ;FIRST DEFAULT FILE CONTROL BLOCK ADDRESS
LEAD            EQU     2EH     ;LEADING CHARACTER FOR DISK SPACE
LF              EQU     0AH     ;LINE FEED
TAB             EQU     09H     ;TABULATION CHARACTER
;
;       8 INCH
;DENSITY         D O U B L E             S I N G L E
;SIDES           D S     S S             D S     S S
;TOTAL          1216K    508K           494K    243K
;DIRECTORY        8K      4K              4K      2K
;AVAILABLE      1208K    504K           490K    241K
;CLUSTER SIZE     2K      2K              2K      1K
;SECTORS/CLUSTER 16       16             16       8
;CLUSTERS        608      254            247     243
;
;       5 INCH
;DENSITY         D O U B L E             S I N G L E
;SIDES           D S     S S             D S     S S
;TOTAL           390K    190K           173K     83K
;DIRECTORY        4K      2K              2K      2K
;AVAILABLE       386K    188K           171K     81K
;CLUSTER SIZE     2K      1K              1K      1K
;SECTORS/CLUSTER 16       8              8       8
;CLUSTERS        195      190            173     83
;
        ORG     0100H
STARTUP:
        LD      SP,STACK$AREA   ;SET UP STACK
        LD      IX,COUNT
        LD      IY,TOTAL
        IF      CROMEMCO
        LD      C,SPECIAL       ;CRT special function call
        LD      DE,0            ;Clearscreen - NOT cursor control
        CALL    CDOS
        ENDIF
        LD      A,(FCB1)        ;GET DRIVE SPECIFIER
        SUB     01H
        LD      E,A             ;SAVE IN CASE NOT CURRENT DRIVE
        CP      0               ;IS IT CURRENT DRIVE
        JP      M,NOFCB
        LD      C,SELECT
        CALL    CDOS
NOFCB:  LD      C,CURRENT
        CALL    CDOS
        ADD     41H             ;CONVERT TO ASCII
        LD      (DISK),A
        LD      DE,MSGBEG       ;START MESSAGE
        CALL    STOUT
        LD      C,ALLOCATION    ;GET BIT MAP
        CALL    CDOS
        LD      (BITMAP),BC     ;SAVE STARTING ADDRESS
        LD      (TOTAL),DE      ;SAVE TOTAL NUMBER OF CLUSTERS
        LD      (SECTORS),A     ;SAVE SECTORS/CLUSTER
        DEC     DE              ;FIRST TWO CLUSTERS RESERVED
        DEC     DE
        LD      (CLUSTERS),DE   ;SAVE NUMBER OF USEABLE CLUSTERS
        LD      A,-1            ;READ SURFACE 0 FOR DISK LABEL
        OUT     AUXDSK,A
        LD      B,80H           ;CURRENT DISK - INTERLEAVED
        LD      DE,0
        LD      C,RDBLOCK
        CALL    CDOS
        LD      A,(SECTORS)
        CP      10H
        JP      M,THIRD         ;IT MUST BE  8 SECTORS / CLUSTER
        LD      A,2
        JR      VALUE
THIRD:  LD      A,1
VALUE:  LD      (DOUBLE),A      ;TWO †† VALUE = SECTORS / CLUSTER
        LD      A,(0FAH)        ;GET SIDES      (D OR S)
        CP      'D'
        JR      NZ,OKGO
        LD      A,(0F8H)        ;GET DISK SIZE (L OR S)
        CP      'L'
        JR      NZ,OKGO
        LD      A,(0FCH)        ;GET DENSITY   (D OR S)
        CP      'D'
        JR      NZ,OKGO
        LD      A,4
        LD      (DOUBLE),A
OKGO:   LD      DE,ROOM         ;PRINT SOME BLANK SPACES
        CALL    STOUT
        LD      HL,(BITMAP)
MAPIT:  RLC     (HL)            ;GET HIGH BIT INTO CARRY REGISTER
        LD      A,0             ;SAVE A "0" FOR NOW
        JR      NC,BINARY
        LD      DE,(USED)       ;CLUSTER IS USED - INCREMENT
        INC     DE
        LD      (USED),DE
        LD      A,1             ;CHANGE "A" TO "1"
BINARY: ADD     30H             ;CONVERT TO ASCII CHARACTER
        LD      E,A             ;PRINT THIS CHARACTER
        LD      C,2
        CALL    CDOS
        LD      A,(BITS)        ;COUNT 'HL' BITS MOVED INTO CARRY REGISTER
        INC     A
        LD      (BITS),A
        LD      DE,(COUNT)      ;GET & INCREMENT CLUSTER COUNT
        INC     DE
        LD      (COUNT),DE
        LD      A,(IX+1)        ; G E T  MSBits - COUNT
        CP      (IY+1)          ;COMPARE MSBits - TOTAL
        JR      NZ,NOCOMP
        LD      A,(IX)          ; G E T  LSBits - COUNT
        CP      (IY)            ;COMPARE LSBits - TOTAL
        JR      Z,DONE          ;QUIT IF YOU DONE THEM ALL
NOCOMP: LD      A,(ROWS)        ;GET COUNT OF DIGITS ON THIS ROW
        INC     A
        LD      (ROWS),A
        CP      28H             ;END FIFTH  GROUP - END ROW
        JR      Z,LINE
        CP      20H             ;END FOURTH GROUP - SPACE SOME
        JR      Z,BLANK
        CP      18H             ;END THIRD  GROUP - SPACE SOME
        JR      Z,BLANK
        CP      10H             ;END SECOND GROUP - SPACE SOME
        JR      Z,BLANK
        CP      08H             ;END FIRST  GROUP - SPACE SOME
        JR      NZ,MAPIT
BLANK:  INC     HL              ;GET NEXT GROUP
        LD      DE,ROOM         ;PRINT SOME BLANK SPACES
        CALL    STOUT
        LD      A,0
        LD      (BITS),A        ;SET COUNT OF GROUP DIGITS TO "0"
        JR      MAPIT
LINE:   INC     HL              ;GET NEXT CLUSTER GROUP
        LD      A,(DOUBLE)      ;GET FLAG FOR LINE SPACING
        LD      DE,TWOLF
        CP      4               ;MUST SINGLE SPACE
        JR      NZ,SINGLE
        LD      DE,CRLF         ;CARRIAGE RETURN - LINE FEED
SINGLE: CALL    STOUT
        LD      DE,ROOM         ;PRINT SOME BLANK SPACES
        CALL    STOUT
        LD      A,0
        LD      (BITS),A        ;SET GROUP DIGITS COUNT = "0"
        LD      (ROWS),A        ;SET  ROW  DIGITS COUNT = "0"
        JP      MAPIT
DONE:   LD      A,(BITS)
        CP      07H             ;END LAST GROUP
        JR      Z,ATLAST
        RLC     (HL)            ;KEEP ROTATING UNTIL IN ORIGINAL ORDER
        INC     A
        LD      (BITS),A
        JR      DONE
ATLAST: LD      DE,CRLF         ;CARRIAGE RETURN - LINE FEED(S)
        CALL    STOUT
        LD      A,(DOUBLE)      ;GET DOUBLING FLAG
        CP      2
        JP      M,NOTDD         ;NO DOUBLING REQUIRED
        CP      4
        JP      M,ONCE
        CALL    DIR2            ;CLUSTER (2K) -  QUAD  DIRECTORY (8K)
ONCE:   CALL    TWOX            ;CLUSTER (2K) - DOUBLE DIRECTORY (4K)
NOTDD:  LD      HL,DISKUSED     ;PUT DISK SPACE USED HERE
        LD      BC,(USED)
        DEC     BC              ;TWO CLUSTERS FOR DIRECTORY
        DEC     BC
        LD      (USED),BC       ;ACTUAL DISK SPACE USED
        LD      A,LEAD
        CALL    BIND
```

```
        LD      HL,(CLUSTERS)   ;TOTAL USEABLE DISK SPACE
        LD      BC,(USED)
        SBC     HL,BC           ;FIND DISK SPACE LEFT
        LD      (DISKOPEN),HL
        LD      HL,DISKLEFT     ;PUT DISK SPACE LEFT HERE
        LD      BC,(DISKOPEN)
        LD      A,LEAD
        CALL    BIND
        LD      HL,DISKSPACE    ;PUT DISK SPACE AVAILABLE HERE
        LD      BC,(CLUSTERS)   ;TOTAL USEABLE DISK SPACE
        LD      A,LEAD
        CALL    BIND
        LD      DE,MSGEND       ;TERMINATION MESSAGE
        CALL    STOUT
        JP      0000            ;BACK TO DOS PROMPT
;
TWOX:   LD      DE,(CLUSTERS)   ;GET OLD CLUSTER COUNT
        LD      HL,(CLUSTERS)
        ADD     HL,DE           ;DOUBLE IT
        LD      (CLUSTERS),HL   ;SAVE IT BACK IN <CLUSTERS>
DIR2:   LD      DE,(USED)       ;GET USED COUNT
        DEC     DE
        DEC     DE              ;SUBTRACT TWO FOR DIRECTORY
        LD      HL,(USED)
        ADD     HL,DE           ;DOUBLE IT
        LD      (USED),HL       ;SAVE IT BACK IN <USED>
        RET
;
STOUT:  LD      C,PRINT         ;OUTPUT STRING
        CALL    CDOS
        RET
;
MSGBEG:         DB      TAB,TAB,TAB,'FLOPPY DISK - '
DISK:           DB      '  - CLUSTER MAP',TAB,TAB,'Version 2.1'
TWOLF:          DB      LF
CRLF:           DB      CR,LF,'$'
ROOM:           DB      '        $'
MSGEND:         DB      LF,TAB,'This disk uses'
DISKUSED:       DB      '       K with'
DISKLEFT:       DB      '       K left out of'
DISKSPACE:      DB      '       K allowable',CR,LF,'$'
BITMAP:         DB      0,0
CLUSTERS:       DB      0,0
COUNT:          DB      0,0
DISKOPEN:       DB      0,0
TOTAL:          DB      0,0
USED:           DB      0,0
BITS:           DB      0
DOUBLE:         DB      0
ROWS:           DB      0
SECTORS:        DB      0
STACK$AREA      EQU     $+30H
```

```
C.BITMAP
                        FLOPPY DISK - C - CLUSTER MAP           Version 2.1

      11111111        11111111        11111111        11111111        11111111

      11111100        00000000        00000000        11111111        11111111

      11111111        11111111        11111111        11111111        11111111

      11111111        11111101        11111110        00000000        00000000

      00000000        00000000        00000000        00000000        00000000

      00000000        00000000        00000000        00000000        00000000

      00000000        000000

       This disk uses ..244 K with ..260 K left out of ..504 K allowable
```

```
C.BITMAP A:
                        FLOPPY DISK - A - CLUSTER MAP           Version 2.1

      11111111        11111111        11111111        11111111        11111111

      11111111        11111111        11111111        11111111        11111111

      11111111        11111111        11111111        11111111        11111111

      11111111        11111111        11111111        11111111        11111111

      11100000        00000000        00000000        000000

       This disk uses ..161 K with ...27 K left out of ..188 K allowable
```

About The Author

LT. COL. JAMES R. GUNKEL is a Program Manager for the United States Air Force, dealing with the acquisition of simulation devices for the military. He holds a B.S. Degree in Chemical Engineering from Arizona State University, and has earned Masters Degree credits in Operations Research/ Computer Science. Jim is anticipating a second career in the field of computing when he retires from the USAF in two years. He has indicated that he can make the above program, as well as several others listed below, available to members of IACU for nominal copying charges of $24.95 each. All are available on either 5¼" or 8" floppy disks.

Other programs available:
BITMAP — SOURCE AND .COM FILES
COPYDISK — SOURCE AND .COM FILES
MENU — SOURCE AND .COM FILES
DRIVERS — EXPANDED TO INCLUDE
    SOROC 120
    MICROTHERM ACT IV
    HEATHKIT 19 (NOT FINAL)
REPGEN — DBMS REPORT GENERATOR IN 16K BASIC

The programs can be ordered from:
MICRO COMPUTER CENTER
7900 Paragon Road
Centerville, Ohio 45459
Phone: (513) 435-9355

Polynomial Interpolation

Continued from page 1

the points with a continuous curve which goes through all of them without a break or a kink? Well, the problem is that there are an infinite number of curves that go smoothly though the points, and unless we can define what the French curve (or the artistic hand) does in a precise mathematical way, the computer is stuck. This particular problem — smoothly filling in the blank spaces between data points — is the subject of this article.

Fortunately, this problem has appeared many times before, and some prodigious mathematical talents have thought about it with some success. One approach is to imagine that the desired line is made out of a springy ribbon of steel and that a pair of pins is stuck into the paper at each data point with just enough space between them to accommodate the steel ribbon. The laws of physics tell the steel ribbon to take the form with the least amount of elastic strain, and this determines the path of the ribbon uniquely. The curve generated in this manner is called a Cubic Spline. A spline is the name for a long, thin piece of wood, (which the old-time shipbuilders used instead of a steel ribbon), and the curve which minimizes the amount of elastic energy between any two of the constraint points of the spline is a third order (cubic) polynomial. Thus, the spline curve of the old-time shipbuilders is a concatenation of pieces of cubic polynomials. In today's terminology, a spline refers to a concatenation of segments of any curve, but the cubic variety is still the most popular.

Another approach is to draw a single polynomial curve of the lowest possible degree that goes through all of the points, and this is the method used in this article.

II MATHEMATICAL DERIVATION

It is traditional in this type of article to invite the gun shy to skip this section and simply go to the end and copy down the code. Since the code is very short, and in my humble opinion well documented, you can probably get it to work without reading this paragraph, but have a look at it anyway. Some of my friends say it isn't hard to follow.

Suppose we have n points with coordinates x and y . Recognizing that the y coordinates of these points are independent, it is clear that there must be at least n free parameters in any equation that goes through them. Since a polynomial has a constant term (a constant has a power of zero) as well as free coefficients for each of the other powers of x, the degree of the polynomial will have to be at least equal to $n-1$. So let's try to make a precise mathematical statement of what we are looking for as follows:

> Find the unique polynomial with degree equal to one less than the number of data points which goes through all of them.

This won't quite finish off the problem because it leaves open the question of which are the best places to pick the n points, but we can leave that question until later. Assume for now that we only have n points, and that these are the ones to be fitted.

Our immediate problem is to develop equations for the coefficients (including the constant term) from the coordinate values of the points to be fitted. Before we get any farther, however, another interesting question is what polynomial form should be used to express this polynomial?

Wait a minute! I hear you cry. What do you mean? Aren't all polynomials expressed as a sum of powers of x?

No, not all polynomials are expressed that way, and there are cogent reasons for examining this question in detail. First of all, the accuracy of the y coordinates that are produced by an equation can become compromised if the calculation involves cancellation between several large contributions coming from different terms. This problem is less severe if the individual terms somehow come out to be of different magnitudes. Often this can be guaranteed if the polynomial is expressed as sums of combinations of powers rather than as sums of the isolated powers themselves. Second, there are specific polynomial forms that are much easier to calculate than the simple one we all learned in algebra class. Both of these points are the inspiration for writing this article, for there appears to be a handy dandy polynomial form that is particularly easy to calculate and which also has greater accuracy than the common form.

There are a lot of subtle considerations involved in choosing a polynomial form for expressing an interpolator function. First, there is the question of how much computation is required to evaluate it (once the coefficients are known); and second, there is the question of the computation required to evaluate the coefficients themselves. In applications where a large number of interpolated points are calculated for each determination of a coefficient set, the latter question is probably not important, but there are also cases where much more time is spent on evaluating coefficients than is used to calculate interpolated values. In these cases, it is obviously important to have a simple way to get from the data coordinates to the coefficients. The method outlined below is very good in both of these respects.

Without a doubt, the easiest polynomial form to evaluate is the nested form of the power series. This form requires only n – 1 multiplications and n additions as can be seen in the following equation:

$$Y = C(1) + x[C(2) + x[(c(3)) + x[\ldots]]]$$

Unfortunately, the coefficients of this form are among the hardest to calculate, and the result is the least accurate. The form with the easiest coefficients to evaluate is probably the Lagrange form. It is so easy, one can write an expression for each coefficient by inspection! But, as you might suspect, given the law of conservation of grief, this form is the most difficult to evaluate. It requires almost n squared multiplications as well as 3 times n squared additions and subtractions. But as an added bonus, it gives the most accurate result.

The Lagrangian form is:

$$Y = \frac{(x-X(2))(x-X(3))\ldots(x-X(n))}{(X(1)-X(2))(X(1)-X(3))\ldots(X(1)-X(n))}Y(1) + \frac{(x-X(1))(x-X(3))(x-X(4))\ldots(x-X(n))}{(X(2)-X(1))(X(2)-X(3))\ldots(X(2)-X(n))}Y(2) + \ldots$$

Each of the terms has a numerator consisting of a product of n – 1 first order factors, so each is a polynomial of that degree. The total expression is therefore also a polynomial of degree n – 1 as required. Each numerator is constructed by starting with

$$(x-X(1))(x-X(2))\ldots(x-X(n))$$

and deleting one factor. (A different factor is deleted for each term.) The denominators are constructed similarly except only constants (i.e. the coordinates of the data points) are used. The neat thing about this form is that each term except one disappears at every one of the data points. The term that does not disappear is the one whose numerator does not contain the factor that goes to zero there. Furthermore, the numerator and denominator of the non-disappearing term are exactly equal at that point. Thus, at each data point the value of the entire expression comes from only one term, and its value is obviously the y coordinate of that point. Thus, the Lagrange polynomial goes through each and every data point as required. In this example, you can see what is meant by different forms of a polynomial. In this case, the polynomial is expressed as a sum of polynomials, each of which has all of the powers of x. If we multiplied all of these out and combined terms, we would get exactly the same coefficients as before, but when we evaluate the Lagrange form, we will not get exactly the same result because of different round-off errors. The Lagrange form is more accurate because each term has its maximum magnitude at its "own" data point, and all other terms go to zero there. Hence, there is a minimum of cancellation between terms.

In the course of puzzling over these matters, a nice compromise between the two extremes discussed above was discovered (or probably re-discovered). It permits a nested form for fast evaluation, and the equations for the coefficients are simpler than those for the direct polynomial form. This method (like the Lagrange method) uses products of first-order factors which go to zero at the locations of the data points instead of simple powers of x. But we will use fewer of these factors than appear in the Lagrange form. We will use:

$(x-X(1))$ instead of x for first order terms
$(x-X(1))(x-X(2))$ instead of x^2 for second order terms
$(x-X(1))(x-X(2))(x-X(3))$ instead of x^3 for third order terms etc.

Here, you will remember, X(1) was the x coordinate of the first of the points the curve is to go through, etc.

Another way to express the above approach is that the interpolator function itself will have the (non-nested) form:

$$Y = C(1) + C(2)(x-X(1)) + C(3)(x-X(1))(x-X(2)) + \ldots$$

or in an equivalent (nested) form:

$$Y = C(1) + (x-X(1))[C(2) + (x-X(2))[C(3) + \ldots]]].$$

If the second of the two forms given above is

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Polynomial Interpolation

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multiplied out, the result is exactly the same as the first, but it is not exactly equivalent to the first form in several respects. First of all, the second form requires fewer multiplications and fewer subtractions to evaluate (so it's faster to calculate), and second, since quantities are added together in a different order, cancellation problems that occur in one form probably won't occur in the other.

I'm sure you all agree that the above forms are indeed polynomials of degree n – 1, but you are probably wondering whether it is really advantageous to use such a complicated form. There are two reasons: First, when one uses the common polynomial form, all of the terms except the constant term disappear at x = 0 and all terms start to contribute as one moves away from zero. At first (i.e. for x close to zero) the higher order terms are the smallest, but as one moves farther and farther from X = 0, these terms gradually become more important until finally the highest one dominates. At any intermediate value of x, two or three terms usually contribute heavily to the final value, and they usually do so with opposite sign. Thus, cancellations are a frequent occurence. In the form advocated above, however, each individual term has additional places where it goes to zero. Since the higher order terms have more zero locations, these terms tend to remain small except in the specific regions where they dominate the picture. Since each term is kept out of the picture (more or less) until it becomes large, there is less cancellation in evaluating the proposed form than is encountered in the common form.

The second answer is also a cogent one: Namely the equations for the coefficients are easier to solve when most of the terms drop out, and this is exactly what happens when we use the first order factors presented above instead of simple powers of x. To see this point more clearly, remember that the equations for the C's are obtained by requiring that the polynomial form give us back Y(i) for each of the X(i). Any time an (x – X(i)) appears in these equations, the term containing it will drop out. The basic equation (which must give the right answer at every data point) is the interpolator in the non-nested form given above:

Y = C(1) + C(2)(x – X(1)) + C(3)((x – X(1))(x – X(2)) + ...

Let us enumerate the equations that apply at each data point. Starting at X(1), we have (after dropping the dead terms),

Y(1) = C(1)
Y(2) = C(1) + C(2)(X(2) – X(1))
Y(3) = C(1) + C(2)(X(3) – X(1)) + C(3)(X(3) – X(1))(X(3) – X(2))
Y(4) = etc.

The first of these is obviously a snap! So C(1) can be considered a known quantity when we come to the second equation. Under this assumption, the only unknown in the second equation is C(2), so we can also solve it with no problem. Thus, in contemplating the third equation, we can assume that both C(1) and C(2) are already known. Therefore, the third equation also only contains one unknown coefficient, namely C(3). By now you see the strategy. We have concocted a set of equations such that only one additional unknown is introduced at a time. This means that we are repeatedly confronted with solving one equation in one unknown rather than having to solve many simultaneous equations with many unknowns. Not only is this easier, but it has the added advantage of providing greater accuracy. In the jargon of mathematics, the set of equations we have to solve is more "well conditioned" than the set involving all of the unknowns at once. By relating each coefficient to only one new data point at a time, there is less error propagation than occurs when the whole bunch gets untangled at once.

Well, that's the trick. The rest of it is just a matter of coding. This is done in the following paragraphs in Microsoft Basic and also in Fortran. The Basic program is actually just an exerciser for the two GOSUBS at 1000 and 2000 which respectively return the coefficients (1000), and evaluate the polynomial form (2000). The Fortran code consists of a SUBROUTINE that returns the coefficients and a FUNCTION that evaluates the polynomial form.

BASIC PROGRAM

```
10 REM POLYNOMIAL INTERPOLATION
19 REM DEMONSTRATE PROGRAM WITH 5 POINT
     (4TH DEGREE) FIT
20 DIM X(5),Y(5),C(5)
29 REM SET N = NUMBER OF POINTS FITTED (ORDER
     OF POLY + 1)
30 N=5
39 REM SET FIRST IN VALUES OF X(I) AND Y(I) WITH
     PTS TO BE FITTED
40 FORI=1 TO N:READ X(I),Y(I):NEXT I
50 DATA 1,1 , 2,2.2 , 3,3.2 , 4,4 , 5,4
59 REM VERIFY POINTS
60 FORI=1 TO N:PRINT X(I),Y(I):NEXT I
80 GO SUB 1000 :REM USES X(I),Y(I), AND N; AND
     RETURNS C(I)
100 FOR X=0 TO 10 STEP .1
110 GOSUB2000: REM USES X,X(I),C(I) AND N; AND
     RETURNS Y
119 REM VERIFY INTERPOLATED VALUES
120 PRINT X,Y
130 NEXT X
200 STOP
1000 C(1)=Y(1):FOR I=2 TO N:S=-Y(I)
1020 FOR J=1 TO I-1:S=(S+C(J))/(X(I)-X(J)):NEXT J
1050 C(I)=-S:NEXT I :RETURN
1060 REM
2000 IF N=1 THEN Y=C(1):RETURN
2010 Y=C(N):FOR I = N - 1 TO 1 STEP - 1
2020 Y=C(I)+(X-X(I))*Y:NEXT I :RETURN
2030 REM
```

FORTRAN ROUTINES

```
C ****
      SUBROUTINE COEF (DATAX,DATAY,C,NPTS)
C     THIS ROUTINE RETURNS THE COEFFICIENTS OF THE
C      INTERPOLATOR
C     DATAX,DATAY ARE ARRAYS OF X AND Y COORDI-
C      NATES OF
C     POINTS TO BE FITTED. C IS ARRAY FOR COEFS,
C     NPTS IS # OF POINTS TO BE FITTED
      DIMENSION DATAX(1),DATAY(1),C(1)
```

```
      C(1) = DATAY(1)
      IF(NPTS.LT.2)RETURN
      DO 10 I = 2,NPTS
      S = -DATAY(I)
      K = I - 1
      DO 20 J = 1,K
20    S = (S + C(J))/(DATAX(I) - DATAX(J))
10    C(I) = -S
      RETURN
      END
C ****
      FUNCTION YINTRP(X,C,DATAX,NPTS)
C     THIS FUNCTION RETURNS THE Y CO-ORD OF THE
C     INTERPOLATED CURVE AT X. C IS ARRAY OF
C     COEFFS, DATAX IS ARRAY OF X CO-ORDS
C     OF DATA POINTS, NPTS IS THE # OF
C      POINTS FITTED
      DIMENSION C(1),DATAX(1)
      YINTRP = C(NPTS)
      IF(NPTS.LT.2)RETURN
      N1 = NPTS - 1
      DO 10 J = 1,N1
      I = NPTS - J
10    YINTRP = C(I) + (X - X(I)) * Y
      RETURN
      END
```

About The Author
Dr. Jerome J. Tiemann

The threads that led to this article lead back at least to the early 1950's when Jerry came to Stanford to get a PhD in physics. That was where he first learned to program a computer, and it was no mean feat. There were no high level languages at all in those days and one had to deal with rather bizarre instruction sets with one's bare hands, so to speak. The computers available at the Stanford Computation Center were the IBM 605 and, later on, one of the first IBM 650's. This three address programmer's nightmare combined the limitations of a 2000 word magnetic drum memory with the inconvenience of an I/O system that required one to wire up one's own plug board. But an even more significant thread was the fact that Jerry was more often seen in the company of the EE grad students than with his fellow physicists. His continuing interest in EE (which was one of his two minor fields) led to a close and continuing relationship that led to the meeting of Jerry and a young grad student named Roger Melen in the early 1970's. Their mutual interests at the time were centered around Integrated Circuits for Analog Signal Processing, but when Roger evolved into Computers, it only increased their area of mutual interest.

Jerry was one of Cromemco's earliest customers, both for his own personal computer and those used "at work." Work, for Jerry is still pretty much the same as it was back at Stanford. He is on the Scientific Staff of the General Electric Corp. R/D Ctr., and he works on electronic systems, solid state electronic circuits, and novel electronic devices for implementing them. He holds over 50 patents, is the author of over 80 technical articles, and is a Fellow of both the IEEE and the American Physical Society.

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INTERNATIONAL GROUP TREASURY SYSTEM

By Nicolas J. Hodson

The Peninsular and Oriental Steam Navigation Company was granted a Royal Charter in 1840 to operate Liner Trades, in particular carrying the Royal Mail from the United Kingdom to the Spanish Peninsula and to the Orient (Egypt). Before long the Directors realized the lucrative business to be done in operating passenger and goods trade to India. They established an overland service between Port Said and Suez, using up to 4000 camels per ship to transport the passengers, their luggage and stores, including coal. From Suez to Bombay the ships sailed on a regular timetable. Going to India, down the Red Sea, the cool side of the ship was the port side, and on the return it was the starboard side. The richest passengers travelled Port Out Starboard Home, or POSH — one of the earliest acronyms. Later on, the liner trade to Australia became established and travelling by P&O was the normal way of going from Britain to India and Australia, until the aeroplane finally banished the passenger liner in the mid 1960's.

During its first 130 years the company took over or combined with many well known shipping companies, for example British India, The New Zealand Shipping Co., General Steam, Orient, and many others. By 1970 the operations of all these companies needed to be rationalized, and the consultancy firm, McKinsey & Co., was brought in to recommend what should be done. The Group was re-formed in October 1971, structured into Divisions, each responsible for a class of trading. For example, Bulk Shipping Division deals with oil, ores, etc., while Passenger Division deals with Passenger Cruise Ships (no longer liners now) including Princess Cruises, Inc., operating on the U.S. West Coast. The Group has also diversified into several other non-shipping fields.

We shall seek to explain the Banking System, by describing why such a thing is necessary to a Global Corporation such as the P&O, and what one hopes to gain from it.

In order to finance the building of new ships for its fleet, and to stabilize its financial activities, the Company borrows large amounts on the international money market. The majority of these borrowings are in Sterling, Deutschmarks, U.S. Dollars and Norwegian Kroner, but quite large amounts of other currencies are involved as well. The total amount is of the order of $600 million. You can see that even if we could influence the effective interest rates by only one percent, this would amount to six million dollars in actual cash — quite a tidy sum for one little Cromemco System Three to be making for its owners.

About ten years ago the majority of our borrowings were in respect of ships. They were almost always for a fixed proportion of the vessel, generally 80%, repayable in 16 equal instalments over the life of the vessel. In addition, the payments to the shipyard were financed by predelivery loans. Such shipbuilding loans were deemed to be necessary, since one method of judging the viability of purchasing a new ship showed clear advantages if the money could be borrowed, and repaid out of earnings. The flaw in this was that one was maintaining a fleet, and providing a service, rather than indulging in entrepreneurial activities.

The secondary data files consist of sorted pointers to the first records of the various chains, thus enabling reports to be generated in which the output is, for example, by Division/Project type/Currency. There are also certain intermediate working files, which are written in accidental order, and sorted by pointers, enabling, for example, a detailed breakdown of the balances by bank to be made. This is done because it is necessary to know exactly what one's exposure to a given bank is, even though that bank may in some cases be only a partner in a syndicate of banks.

Finally, all the output reports can be generated in either manual mode (where one types in each command as it is required), or else in auto mode (where the commands are read off a control file). Since the printing of the reports is about a day's work even on a Diablo 1641, this is quite an advantage, but necessitates an editor for the control file.

For the most part the interest rates are not fixed, but vary according to one of several Base Rates. The two most important of these are Libor (London Inter-Bank Offer Rate) for Sterling, and the Eurodollar Rates for US$. We are less affected by US Prime Rates.

When a new project is started, and the Group Treasurer is looking for finance for it, he has to decide which currency he thinks will be the most favorable and which bank or syndicate of banks will give him the best rates. To help answer the

Continued on next page

International Group Treasury System

Continued from page 21

first question he needs to know a great deal about the company's potential cash flow profile in the proposed currency, since he does not necessarily wish to buy in, say Kroner, though at times it is an advantage. Needless to say, his cashiers watch the exchange rates like hawks.

Once he has made a basic agreement with a bank (or syndicate), he then has to decide how the agreement is to be met in the immediate future. This is because he generally has the option of fixing the rates with the bank for 1, 2, 3, 6 or 12 months ahead. Each bank offers different rates for these periods, and in any case the loan will have been agreed with a fixed percentage over the base rates in mind. The Group Treasurer has to decide whether it is advantageous to borrow for a short or a long period. He may decide to split the loan so that a portion is borrowed for a short time, to be renegotiated later, while the rest is fixed for a longer period. Such an arrangement is called a Split Period. The new Group Treasury System is able to handle these with ease, merely inserting a new IOU into the IOU chain, and modifying one of the others. The original mainframe system was written when such things were unheard of, and could not be easily modified to cope with them. In such cases it was bound to be wrong in either the Cash Flow Forecast, or in the Accruals of Interest.

Some of the reports produced by the Treasury System are used for the audited financial accounts, and therefore have to be completely accurate. Cromemco's 14-digit arithmetic is most valuable. Various safeguards are built into the data structures, and there are rigorous checks on the data which indicate whenever anything is found to be amiss, as can happen when data is accidentally entered for the wrong IOU.

Such simple loan structures could be kept track of quite easily, since the interest rates were always fixed for eight years ahead, at about 7%. When, in 1973, the author was approached to devise a computer system to help with producing the monthly accrual of interest reports, the balances by bank, and the cash flow forecasts, things were just beginning to change, yet all the necessary information, relating to nearly 200 different loans, was in a pocket diary!

In the last five years very much more complex financing structures have evolved, due in particular to fluctuating interest and exchange rates, coupled with less predictable earnings rates. The money markets have evolved considerably, and the job of a Group Treasurer has evolved with them. The suite of programs to be described was originally written for an IBM 370, where it ran from Oct. 1973 to Dec. 1979, but it was originally specified for a much simpler financial scene, and during that period all sorts of facilities, not originally built-in, had to be buttoned on at great loss of operating efficiency. A careful study of the requirements was made during 1978, and I became convinced that the job could be better done on some form of microcomputer. Further deep study during the spring of 1979 took me to the point of buying a Cromemco System Three in June 1979.

I realized that of the many tasks P&O Finance Division had been running on the 370, the Banking System was the most important, and the one we could least afford to get wrong. During the latter half of 1979 I wrote several other minor systems, before undertaking the major task of redoing the Management Accounts System. This was running by October 1979 in time for setting up our Group Budgets for 1980. The transition was quite smooth, and by mid-December I was ready to begin the Banking System, which had to replace over 100 modules on the 370, and be running at least in parallel by January.

In the event, it was written very quickly, since I was able to write it over the Christmas and New Year breaks, and was able to use the previous December run as a parallel. It took about three weeks of intensive work, walking home at night after the last bus, and so forth. I tried to get one new module operational and tested per day. I mention all this because I don't think it would have been possible without the exceptionally fine BASIC available to Cromemco users, and the trouble-free operation of the System Three which ran uninterruptedly throughout this period. I also had the great advantage of knowing exactly what was required, of having worked out in all but the finest detail how the files would be structured, and of having just written a system of similar complexity and size. Furthermore I had taken care to include the more difficult routines in other programs written in the late summer.

Essentially the data is broken up into Projects, each of which may have up to 31 loans in various currencies. Each loan may be arbitrarily complex. Later we shall describe how this is achieved, but here it suffices to say that a loan is described by a stream of records, called IOU's. The primary data files consist of (A) Project Headers, with pointers to the start of the Loan Header Chain; (B) Loan Headers, with pointers to the start of the IOU Chain; (C) The IOU Chains; (D) A file of general data, such as First Free Record Pointers; (R) A Rates file.

There are numerous methods of computing interest, though only one, which we call the 360 day method is familiar to North American readers. Sterling interest rates are generally quoted for 365 days, while Deutschmark rates are often based on a 360 day year in which every month has 30 days, the odd ones being either ignored, or added in, as necessary. There are also half-year rates, and 90-day rates which are mainly used for leasing.

Economic forecasts, such as future exchange rates and interest base rates, are held in a rates file on a monthly basis. It has been made particularly easy to change the economic assumptions, and the programs then make all the necessary adjustments. Each loan is broken down into a stream of

IOU's, each of which has an associated first and last date, receipts repayments and interest in both currency and "sterling", a balance in currency, excess over base in the case of unfixed loans, and a one-bit flag to indicate that that IOU has been fixed. In the case that this bit is not set, the program determines the currency interest payment from the known base forecast and the excess over base. In the case that "sterling" has not been entered the program uses the exchange rate forecast to predict what it will be. In this way, all reports can be produced in either currency or forecast "sterling". It should be mentioned that there is no reason why any other currency, such as US$, should not be used in place of sterling as the underlying currency for reports.

The programs were written in BASIC for a Cromemco System Three. The machine has proved itself over and over on this one task alone, which has now run for over a year. There are two groups of programs, the first being used for editing and testing the data, and the second for producing the reports.

It was originally envisaged that the editing program would be run on a daily basis, as fresh information came to hand, and in a multi-user environment, but in practice it has been found that the reports produced are quite good enough to stand (with pencilled notes) for a month. We therefore carry out a run on about the 3rd or 4th of the month, which occupies only a few hours of one man's time, and do the printing on the next day. If there are major changes to exchange rates, as at the time of writing, certain reports can be re-run as often as desired.

The system was written so that the data would occupy the smallest possible amount of disk space, consistent with not imposing any serious operational constraint. There are certain limitations built in, but these are far above our foreseeable requirements. In many cases more than one item of data is packed into a single byte, which accounts for some of the lower limit values:

Max no. of Projects	255
Max no. of Loans per Project	31
Max Cap Payment Currencies/Proj.	7
Max no. of Interest Bases	31
Max no. of Loan Security Classes (eg Secured, Unsecured, etc.)	7
Max no. of Project Status (Mortgage, Free, Escrow etc.)	7
Max no. of Project Types (Ship, Aircraft, etc.)	7
Max no. of Currencies (US$, DM, NKr, etc.)	31
Max no. of Divisions	31
Max no. of "Borrowers"	63
Max no. of Banks	253
Max no. of Banks/Syndicate	31
Max no. of free text lines/Loan	7

In addition, space for information such as a project description and whether a loan is fixed/variable and pre/postdelivery, is also provided.

Many thanks to the staff of the Group Treasurer of the P&O SN Company for their great assistance and enthusiasm in developing the system.

About the Author

Nick Hodson was born in London in 1934, and educated in Australia, India and England. He read Mathematics at Balliol College, Oxford, where he was Domus Scholar. After graduating in 1955, his first job was with a shipping company, and he then spent four years working on programs to optimise the design of nuclear power stations. From 1961 to 1969 he taught in various private and public schools, before going back into both shipping and computing with the P&O.

In 1971 he was seconded to McKinsey's to design a modeling system for the P&O's activities, and from that date until the present time he has been responsible for developing the planning, modeling and financial systems for the P&O Group. From 1979 he has carried out these tasks on a Cromemco System Three.

Hodson wrote this article while on a ski holiday in the Austrian Alps.

CDOS REMOTE CONSOLE

Using The Micromodem-100™

Continued from page 1

home or office. One could, of course, pack up all the computer equipment and give the demonstration wherever required. A more practical approach, however, would be to dial up the system and use a portable terminal to give the demonstration.

I also find the feature most useful when doing contract programming. In this case the modem and communications routine is installed in the customer's system. Then any program maintenance can be done without going to the customer's location. This is particularly useful during program development since reported errors can be easily reconstructed by using the actual data causing the error on the customer's system.

No doubt you can think of other uses for a system such as this but we will leave that to your imagination.

The routine described in this article has been tested on CDOS versions 2.17, 2.35, and 2.36. It is written in Z-80 assembly language and assembled with the Cromemco Macro Assembler. Rather than provide a complete listing of the program which would require more space than is available, we will discuss the considerations for writing a remote console routine and how they were addressed for the Cromemco computer and the CDOS operating system in particular.

The design criteria for the CDOS remote console were the following:

1) Interfaces to the operating system must use CDOS standard system calls wherever possible and practical.

2) The routine must be self-relocating since it will have to become a part of the operating system beginning at the lowest address used by CDOS and progressing downward.

3) The routine will have to patch itself into the CDOS I/O drivers so that control will pass to the remote console routine instead.

4) The original console should be active as a parallel console.

5) It must be possible to terminate the remote user from the local console and also to terminate the remote support routine itself without a reboot.

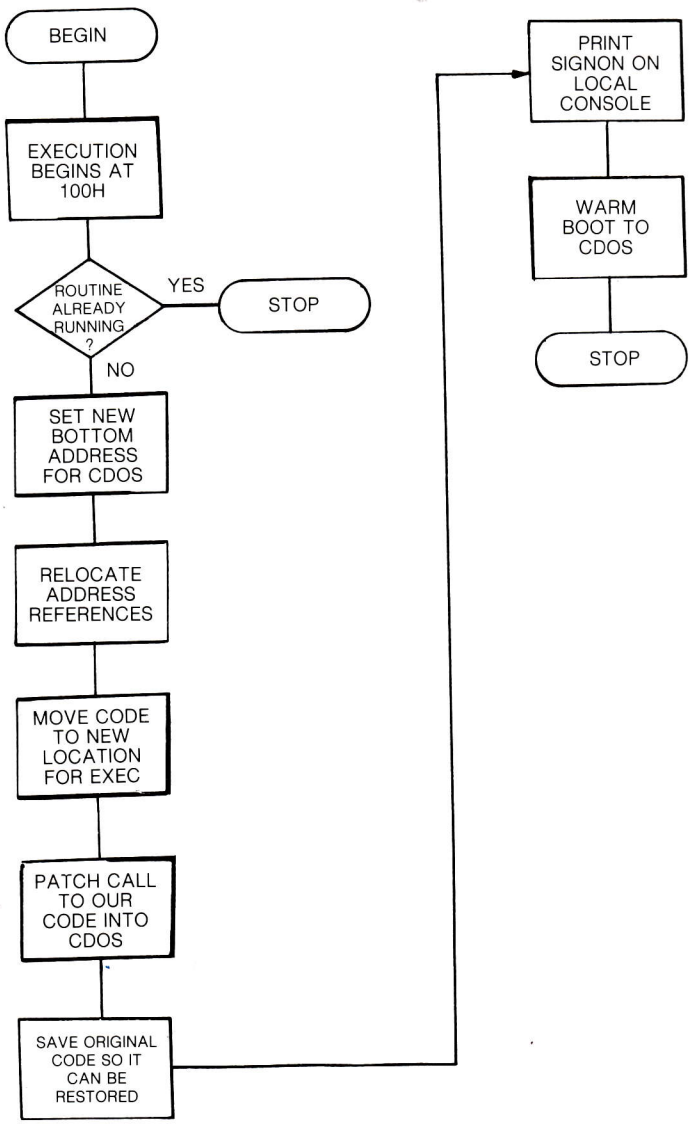
There were some other optional criteria that may or may not be implemented depending upon the amount of space available for dedication to the remote support.

6) The routine must have password protection for system access.

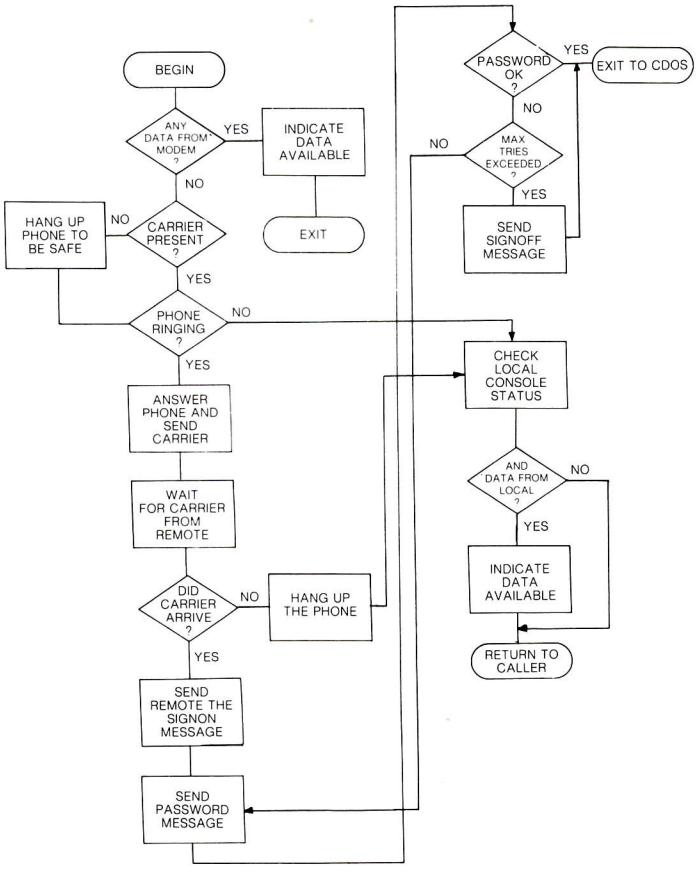
7) The routine must support various command authorities for different users. For example, it may not be advisable for all users to be able to execute the ERAse intrinsic command.

The following flowcharts show the various steps in remote console initialization and operation. Some of the more important steps will be analyzed and discussed in detail later.

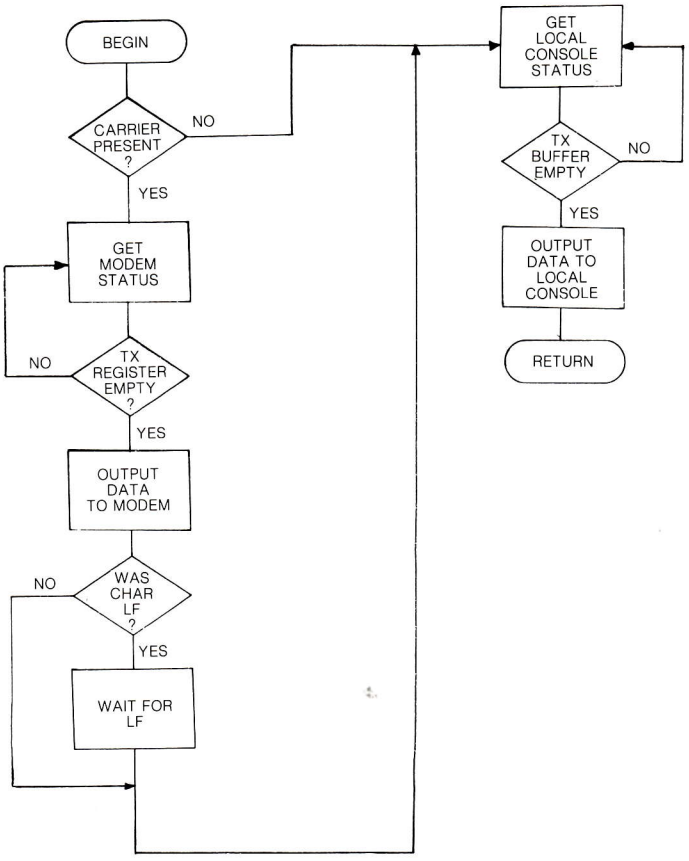
REMOTE CONSOLE SUPPORT INITIALIZATION



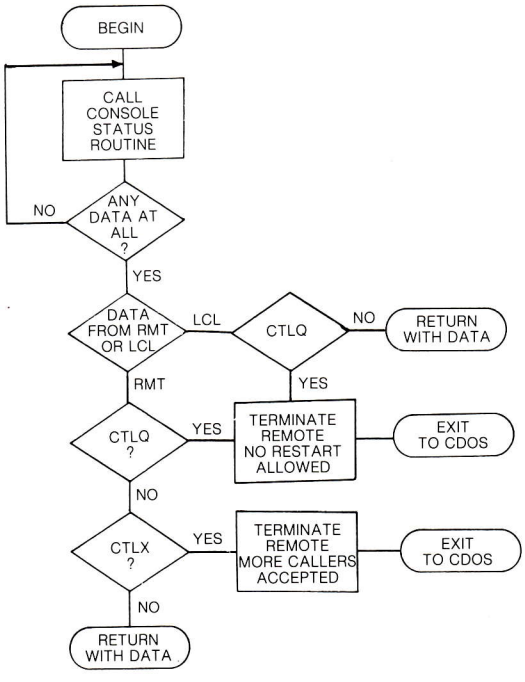
REMOTE CONSOLE SUPPORT
CHECK STATUS OF BOTH CONSOLES



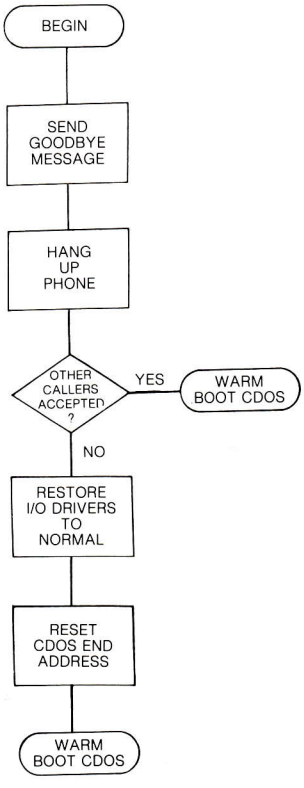
REMOTE CONSOLE SUPPORT
WRITE DATA TO BOTH CONSOLES



REMOTE CONSOLE SUPPORT
READ DATA FROM CONSOLES



REMOTE CONSOLE SUPPORT
TERMINATION



Continued on next page

CDOS Remote Console

Continued from page 25

The manual provided with the D.C. Hayes Micromodem-100™ has a listing of a remote console program as well as a program to install and remove the remote console support. This routine is for use with CP/M 1.4. Many ideas from this routine were used when implementing the CDOS version of the program. Many changes were made, however, that are peculiar to the CDOS implementation. We will now discuss some of the CDOS implementation specifics.

Every effort has been made to allow the routine to be implemented on various configurations of Cromemco/CDOS systems. In order to accomplish this several pieces of information from the CDOS device drivers and CDOSGEN are incorporated into the remote console program. The items needed from CDOSGEN are:

1. The top of user memory.
2. The address of the device drivers.

The items needed from the device drivers are:

1. Displacement to the address of the console status routine.
2. Displacement to the address of the console input routine.
3. Displacement to the address of the console output routine.

Those familiar with the device driver source code will remember that there is a table of routine addresses at the beginning of the drivers. As we will see later, these displacements are used to fetch the addresses of the actual console routines and place a patch in the code to call the new routines that handle both the remote and local consoles at the same time. Without complicating matters more at this time, let us see how the above information is used in the actual remote console program.

Since we will be patching the actual device drivers to call our new routines we will need to first save the original code and then make the patch. Remember we also need to have an orderly way to terminate the routine, so whatever we do must be able to be undone. First, some space must be set aside to save the code we will be replacing:

```
OCONST   DW    0,0          ;save original status routine code
OCONIN   DW    0,0          ;save original input routine code
OCONOUT  DW    0,0          ;save original output routine code
```

Since we will be inserting a call to our routines and a return, four bytes must be saved for later replacement. These fields are where the old code will be saved. Next, we need the calls to our routines that will be inserted:

```
XCONST   CALL  CONST        ;call to new console status routine
         RET
XCONIN   CALL  CONIN        ;call to new console input routine
         RET
XCONOUT  CALL  CONOUT       ;call to new console output routine
         RET
```

These calls will be placed into the device drivers to call our routines after the original code from the device drivers has been saved. After some fields have been defined for addresses and displacements, the code to accomplish the patch would be:

```
LD    HL,(DRIVERS+DCONST) ;point to status routine code
LD    DE,OCONST           ;point to save area
LD    BC,4                ;bytes to move
LDIR                      ;save old code
LD    HL,(DRIVERS+DCONST) ;point to destination
LD    DE,XCONST           ;point to source
EX    DE,HL               ;exchange
LDIR                      ;insert patch
```

The same process is used for the input routine and output routines. The opposite process is used to remove the patches when the routine is terminated. DRIVERS is EQUated to the address of the CDOS I/O drivers. DCONST is EQUated to the displacement to the console status routine address in the routine address table in the device drivers.

Any general purpose routine such as this should be able to calculate its own size and then modify the system accordingly so that it could be easily modified to include additional features. This is accomplished in the following manner:

```
RMTCONS                        ;label on the first program stmt

RMTCONSE EQU   $               ;label after last code generating
                               ;statement

RMTCONLT EQU   RMTCONSE-RMTCONS ;length of routine
RMTCONEP EQU   (USEREND-RMTCONLT)/256*256 ;entry point address
RMTCONHB EQU   RMTCONEP/256     ;high byte for set bottom call
```

With the preceding code in place it is possible to add and remove code from the routine without regard to load points and so forth. CDOS is informed of the changes like this:

```
LD    E,RMTCONHB    ;get high order byte
LD    C,CDOSBOTM    ;request bottom set
CALL  CDOSSERV      ;alter the top of user memory
```

Upon termination of the routine, the end of memory is readjusted by:

```
LD    E,-1          ;signal for reset to original
LD    C,CDOSBOTM    ;request bottom set
CALL  CDOSSERV      ;alter top of user memory
```

So far we have ignored one very important and perhaps difficult aspect of the implementation of this routine, that of relocation. If we load a .COM file containing this program, it will begin execution at location X'100' where all transient programs are loaded. Moving the program itself to the proper location is no big task. In order for it to execute properly, all address references in instructions must be adjusted by the distance the program has been moved, the relocation factor.

The sample program supplied by D.C. Hayes uses a scheme whereby all locations needing relocation are labeled. These labels are placed in a table of address needing relocation, a relocation dictionary of sorts. Before the code is moved to its new location, all addresses are adjusted by the offset required. The relocation scheme will not be discussed here since it is available in the manual supplied with the Micromodem. Dynamically computing the relocation factor is done in the following manner:

```
LD    HL,(CDOSEND)  ;get new end of CDOS
LD    DE,CDOSOVHD   ;allow for CDOS overhead
ADD   HL,DE         ;allow for CDOS overhead
LD    DE,-256       ;allow for our load address
ADD   HL,DE         ;compute relocation factor
LD    (OFFSET),HL   ;save relocation factor
```

Remember that the new end of CDOS has already been set at the time that this code is executed.

With some of the basic housekeeping out of the way we can turn our discussion to the actual input/output routines. Before we turn our attention elsewhere, let's review the functions performed by the initialization section.

1. Check to see if the remote console routine is already executing.
2. Set new bottom of CDOS address to the required value.
3. Relocate address references.
4. Move relocated code to new location under CDOS.
5. Patch in calls to new routines in I/O drivers.
6. Warm boot CDOS.

Of the three input/output routines, the status routine is by far the most complicated. The input and output routines need only to read or write two different ports rather than the usual one. The second port would be the modem port to which the remote console is connected.

The remote console status routine is much more complex because it must:

1. Indicate a character available from either of two sources, remote or local console.
2. It must determine if a remote user has called in and answer the phone to connect him.
3. It must sign on the remote user and ask him for his password if password support is available.
4. It must save the CDOS command table and insert the proper command table to match the user's command authority.
5. If all has gone properly reboot CDOS.

The flowchart for the status routine gives an overview of the functions and order of the status routine. The actual code is shown below. When studying the program code remember that relocation of the appropriate address references must be done as described earlier. Password protection is shown in the example. Modification of the CDOS command table is not shown.

```
CONST                           ;console status routine
        IN      A,STATUS        ;get modem status
        AND     RRF             ;check for character available
        LD      A,255           ;assume there was
        RET     NZ              ;return to caller
        IN      A,STATUS        ;get modem status again
        AND     CD              ;is carrier present ?
        JR      NZ,CONST01      ;if yes...
        LD      A,0             ;mask for phone hangup
        OUT     CCR2,A          ;hang up phone for safety
CONST01                         ;test for phone ringing
        IN      A,STATUS        ;get modem status
        AND     RI              ;is phone ringing ?
        JR      NZ,CONST03      ;if not...
        LD      A,OH+TXE+BRS    ;options to answer phone
        OUT     CCR2,A          ;send data to modem register
        LD      A,PI+LS1+LS2    ;more options for modem
        OUT     CCR1,A          ;send data to modem
        IN      A,DATA          ;clear modem uart
        IN      A,DATA          ;it is double buffered
        LD      B,150           ;constant for wait routine
CONST02                         ;wait for carrier from caller
        CALL    WAIT100         ;call wait routine
        IN      A,STATUS        ;get modem status
        AND     CD              ;carrier yet ?
        JR      NZ,CONST04      ;if yes...
        DEC     B               ;decrement count for wait
        JR      NZ,CONST02      ;if not out of time to wait...
        XOR     A               ;mask for phone hangup
        OUT     CCR2,A          ;hang up the phone no carrier received
CONST03                         ;check local console
        IN      A,CSTATUS       ;get local console status
        AND     CRDA            ;any character ?
        RET     Z               ;if not...
        LD      A,255           ;if yes...
        RET                     ;return to caller
```

```
CONST04                         ;display signon message
        CALL    ANSWER          ;greet the remote user
        XOR     A               ;clear password try count
        LD      (PWCOUNT),A     ;save initial value
CONST05                         ;process one password
        CALL    PASSWRD         ;ask for password
        LD      A,PASSINP       ;point to password input area
        LD      B,PWDLEN        ;get password length
COSNT06                         ;get passowrd characters
        IN      A,STATUS        ;check modem status
        AND     RRF             ;char ready
        JR      Z,CONST06       ;if not...
        IN      A,DATA          ;get the character
        AND     7FH             ;turn off parity bit
        CP      CR              ;carriage return ?
        JR      Z,CONST07       ;if yes...
        LD      (HL),A          ;save in input area
        INC     HL              ;point to next input area
        DJNZ    CONST06         ;if input area not exhausted
CONST07                         ;finished ready or not
        LD      DE,PASSWORD     ;point to password table
        EX      DE,HL           ;exchange
        LD      (PWCURR),HL     ;save pointer to current entry
        EX      DE,HL           ;exchange again
CONST08                         ;check one entry
        LD      A,(DE)          ;get entry byte count
        LD      B,A             ;get to proper register
        INC     DE              ;make DE
        INC     DE              ;     point to
        INC     DE              ;          password
        LD      HL,PASSINP      ;point to password input area
CONST09                         ;check a character
        LD      A,(DE)          ;get a character
        CP      (HL)            ;compare to input area
        JR      NZ,CONST11      ;if not the same...
        INC     HL              ;point to next input char
        INC     DE              ;point to next entry char
        DJNZ    CONST09         ;continue if not finished
        CALL    LOGONMSG        ;display logon message
        JP      CDOS            ;warm boot CDOS
CONST11                         ;no match on password entry
        LD      HL,(PWCURR)     ;restore pointer to current entry
        LD      DE,PWTABSIZ     ;get size of entry
        ADD     HL,DE           ;compute pointer to next
        LD      A,(HL)          ;get possible table end flag
        CP      255             ;end of table ?
        JR      NZ,CONST12      ;if not...
        CALL    BADPWMSG        ;display bad password message
        LD      A,(PWCOUNT)     ;get number of tries
        ADD     1               ;increment tries
        CP      MAXPWCNT        ;more than max allowed ?
        JP      P,ENDRMTRS      ;abort call with restart allowed
        LD      (PWCOUNT),A     ;save updated try count
        JP      CONST05         ;go try again
CONST12                         ;get ready for next check
        LD      (PWCURR),HL     ;save new current pointer
        EX      DE,HL           ;exchange
        JR      CONST08         ;continue
```

The password checking routine makes use of a table and other data that is defined as follows:

```
        PASSWORD                        ;password table
(1)             DB      9               ;length of password
(2)             DW      0               ;no command restriction
(3)             DB      '123456789'     ;user no. 1 password
                DB      9               ;length of password
                DW      0               ;no command restriction
                DB      '987654321'     ;user no. 2 password
                DB      -1              ;end of password table
        PASSINP DS      9               ;password input area
        PWCURR  DW      0               ;save pointer to current password
        PWCOUNT DB      0               ;number of tries by remote user
        MAXPWCNT EQU    2               ;number tries allowed
        PWTABSIZ EQU    12              ;size of a complete table entry
```

Item (1) tells how many characters to be expecting for password input to match this password. Item (2) is used if different command authorities are supported. In this case, it is the address of the table to be used in place of the standard CDOS intrinsic command table. This table would be moved to CDOS after the default table has been saved for later restoration. Item (3) is the password itself. Nine bytes must be defined even though there may be trailing blanks. This is to keep the overall table entry size uniform. PASSINP is where the characters being entered by the remote user are saved for password validation. The number of tries allowed is EQUated to MAXPWCNT.

The following is a list of symbols that have been referenced at various places in this discussion but not previously defined:

Continued on next page

CDOS Remote Console

Continued from page 27

```
DRIVERS   EQU   0FAE5H          ;location of I/O drivers *
USEREND   EQU   0CC00H         ;location of end of user memory *
DCONST    EQU   2              ;displacement to status routine
DCONIN    EQU   4              ;displacement to input routine
DCONOUT   EQU   8              ;displacement to output routine
CDOSBOTM  EQU   151            ;CDOS set bottom call
CDOSOVHD  EQU   9              ;allow for three jumps
CDOSSERV  EQU   5              ;call for CDOS service system call
CDOS      EQU   0              ;CDOS warm boot
CDOSEND   EQU   6              ;location of CDOS end address
```

Items marked with * are peculiar to the installation and must be supplied accordingly from CDOSGEN.

The ideas presented in this article do not represent the last word in teleprocessing software. Hopefully, you will be able to take some of these ideas and implement a similar system on your hardware.

This software has been in use on at least four different CROMEMCO systems for about the past year without encountering any serious problems. Any users that would like to have the complete source code can send either an eight or five inch single density diskette with return postage to:

Robert J. Diersing
4129 Montego
Corpus Christi, Texas 78411
or
6300 Ocean Dr.
Corpus Christi, Texas 78412

About the Author

Robert Diersing is the Director of Computer Services at Corpus Christi State University in Texas where he has been a member of the faculty since 1975. He received both his B.B.A. degree in Electronic Data Processing and M.S. degree in Electrical Engineering from Texas A&I University. Outside the university, he serves as a consultant to the Region II Education Service Center. He has assisted several area school districts with microcomputer hardware selection as well as several local businesses with software implementation on microcomputers. This summer, he will be conducting two workshops on microcomputer programming and operations in local school districts as well as teaching a course in PL/I programming at Corpus Christi State University. This is the first of several articles he has agreed to write for I/O News.

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Continued from page 29

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bits & bytes, nibbles & tweaks...

STAR TREKKER NEEDS SOFTWARE

Bob Feakins, also known as Analytic Associates, the distributor of the games package which includes STAR TREK (see output..., Vol. I, No. 4) is looking for some software. He needs a package which contains multiple linear regression sub-routines, with source codes. Must run under CDOS. Contact Bob at (213) 541-0418.

MICHIGAN GROUP ORGANIZING

The new group announced in the March/April issue held its organizational meeting June 18th. As suspected, both of the individuals in the Greater Detroit Area who were interested in forming groups have combined forces. If interested, contact either Frank Baber at (313) 575-4607 or (313) 759-2152, or Ford Buckner at (313) 420-2183. Buckner reports that the response has been very enthusiastic.

OPTICAL CHARACTER EXPERT SOUGHT

A note from Dan Abelow of Miami Beach, Florida has raised a number of questions. He wrote:

> "I have an enormous amount of information to transfer to my Cromemco system from an existing word processing system. The best way to do this rapidly is through an Optical Character Reader whose output disks are compatible with my Z-2D with double-sided, double-density Tandon drives. Could you please tell me the names of several manufacturers whose Optical Character Readers are compatible with my Cromemco system? The word processing system will print its information in whatever format the OCR requires for most efficient reading."

We would like very much to have this information on file, so if any of you can help out here, send the information to us, and we will get it to Dan right away. Thanks.

CROMEMCOHORTS BUSY

The Los Angeles users' group formed early this year is turning into a very active group. In addition to their regular monthly meetings, they are running a class on 32K SBASIC. Members of IACU interested in affiliating with Cromemcohorts can do so by contacting Dr. William Cannon at (213) 454-0760.

CROSS-COMPILER NEEDED

Professor Richard L. Longini of Canegie-Mellon University sent the following:

> We are using the Cromemco Z2D as a tool in the development of digital instruments. It is used as a source of "data" for the development of these instruments and we have used it to program an 8080 based instrument. We now wish to use it to program a DEC LSI 11 based instrument for which we need a cross-compiler to go from the Cromemco to the LSI 11 micro. Is it possible that someone has reported such a compiler or, perhaps, that a program for it is even available in one form or another?

We would like to know the answer to this, too. If someone who has successfully done this type of interface will get the answers to us, we will forward it to Professor Longini, and keep it on file for others.

PRINTER INTERFACE HELP REQUESTED

Robert Hubenette in Redwood City, California needs a little help with a printer interface. He writes:

> The problem is interfacing the serial board of the Epson MX-80 with the Cromemco TUART board. We do not wish to use the parallel interface since the printer is also used on other computer systems that don't use parallel interface. Since we chose to use the serial interface, the parallel interface is disabled. We have two serial interface boards for the Epson, the 8141 board and the new 8150 (2K buffer) board. What we need to know are the pinouts for the cable and the switch settings and jumpers for the Epson. We use the 2.35 version of CDOS and would also need to know how to reconfigure the BIOS for the new driver.

Again, if you interface experts will send the solution to us, we'll forward it and file it.

MORE ON RETROFIT FANS

Last issue we ran a note on a retrofit fan for our System Two. This generated a lot of calls and letters. One letter asked is there was an equivalent retrofit fan for his System Three. We looked into the matter and found:

1) The basic Systems Two & Three use the same fan.
2) The systems with hard disks use a more powerful fan.
3) Cromemco strongly recommends that multi-user systems incorporate the BRZ-II, or BRZ-III, for System Two or Three, respectively. The BREEZY units fit on the bottom of the cabinet and pull the air out. The fan on the back of the case is then reversed to push fresh air into the system.

Most dealers have a source of fans available to them. Just in case your dealer does not, we will give you the source we ran last issue: Richey Electronics, 10871 La

Continued on next page

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Tuna Canyon Road, Sun Valley, CA 91352. Phone: (213) 768-3800.

SOUTH JERSEY & PHILLY USERS' GROUP STILL GROWING

Jim Lenz, President of Collingswood Computer Center which hosts this group, reports that response to the group has been far more than anticipated. At one recent meeting, more than 80 participants were in attendance. Anyone else anxious to get on this bandwagon can do so by calling Jim at: (609) 488-1144.

NEW ZEALAND ENGINEERING FIRM SEEKING SPECIALIZED SOFTWARE

E.E. Stevens of the prestigious engineering firm of Raines, Rice & Stevens of Auckland, New Zealand sent us this request:

> We are looking for a programme capable of carrying out pipe stress calculations for multi-branch piping systems and capable of running on a Cromemco System 3. We have made various enquiries but so far have found nothing suitable. Accordingly, I would be grateful if you could enquire on our behalf through your "bits & bytes, nibbles & tweaks..." page.

Can any of you specialized engineers find an answer to this request? Please send to IACU for forwarding and filing.

NO RAIN ON NWACU

Seattle, famous for its freshly washed air, is finding itself an ideal climate for the Northwest Association of Cromemco Users, a local group put together by Jim Illman. He reports that the group has attracted what he calls an ideal mix of software and hardware types. If you are in the Great Pacific Northwest and want to affiliate with a most compatible group, call Jim at (206) 932-8771.

CROMIX UTILITIES OFFERED

From David Sutton of SELECT SYSTEMS in England comes the following offer to supply CROMIX utilities:

> We have developed a number of utilities under CROMIX, which we thought may be of interest to other users, if you would consider inserting it into I/O News.
>
> I attach a brief explanation of CROMIX RESOURCE PROTECTION and CROMIX EXTENSIONS, which we have found most useful.
>
> If anyone requires further details or prices I will be pleased to provide them.
>
> **CROMIX RESOURCE PROTECTION**
>
> The Cromix Resource Protection System has been developed as a solution to the problem of simultaneous update protection from different Cromix tasks. The Resource Handler receives request from the user programs via a simple Cromix call. The facility is available to the ASSEMBLER programmer via 'JSYS' calls and to the SBASIC programmer via a modified SBASICIO.SBR (sbasic's device driver routines).
>
> During the course of investigation a number of different solutions to this problem have been found:
>
> 1. The programming of a 'background' task to do all file updating for the system which receives it's requests via common work-files.
> 2. The programming of a 'background' task to do a similar job to the Resource Protection System.
>
> The disadvantage of both these methods is both 'background' tasks need to constantly check to see if a request is being made. This imposes a high CPU/DISK overhead on the Hardware. Another disadvantage is both solutions need an extra memory board to run in, increasing the overall cost of the Hardware.
>
> A point worth mentioning in finding solutions to this problem is that there is a high likelihood that the software produced will be Cromix-dependent and thus restrict the supplier to maintaining separate CDOS and CROMIX versions of the software.
>
> The Resource protection System overcomes all these problems!
>
> 1. The RPS runs in the Cromix bank of memory — needs no extra memory.
> 2. The RPS uses CPU only and then only on a call-for-call basis.
> 3. The RPS SBASIC extensions will call the handler only when working under CROMIX. The calls are ignored under CDOS.
>
> **CROMIX EXTENSIONS**
>
> A number of extensions have been developed to facilitate modification and debugging of the Cromix Operating System.
>
> 1. CALLEX — The provision of two extra Cromix calls to enable the programmer to 'Peek' and 'Poke' into the Cromix-resident bank of memory.
> 2. BUFF — The provision of an applications area within the Cromix-resident bank. This area is 512 bytes long and can contain any code which needs to reside in the Cromix bank.
> 3. SNAP — This facility 'snapshots' Cromix by reading the Cromix-resident bank of memory and outputting this to a disk file.
> 4. AUTO — Automatic selection of device '9' (The hard disk) in Z2-H systems.

If anyone tries these utilities, we'd like to get your reactions.

CP/M SCREEN EDITOR NEEDED

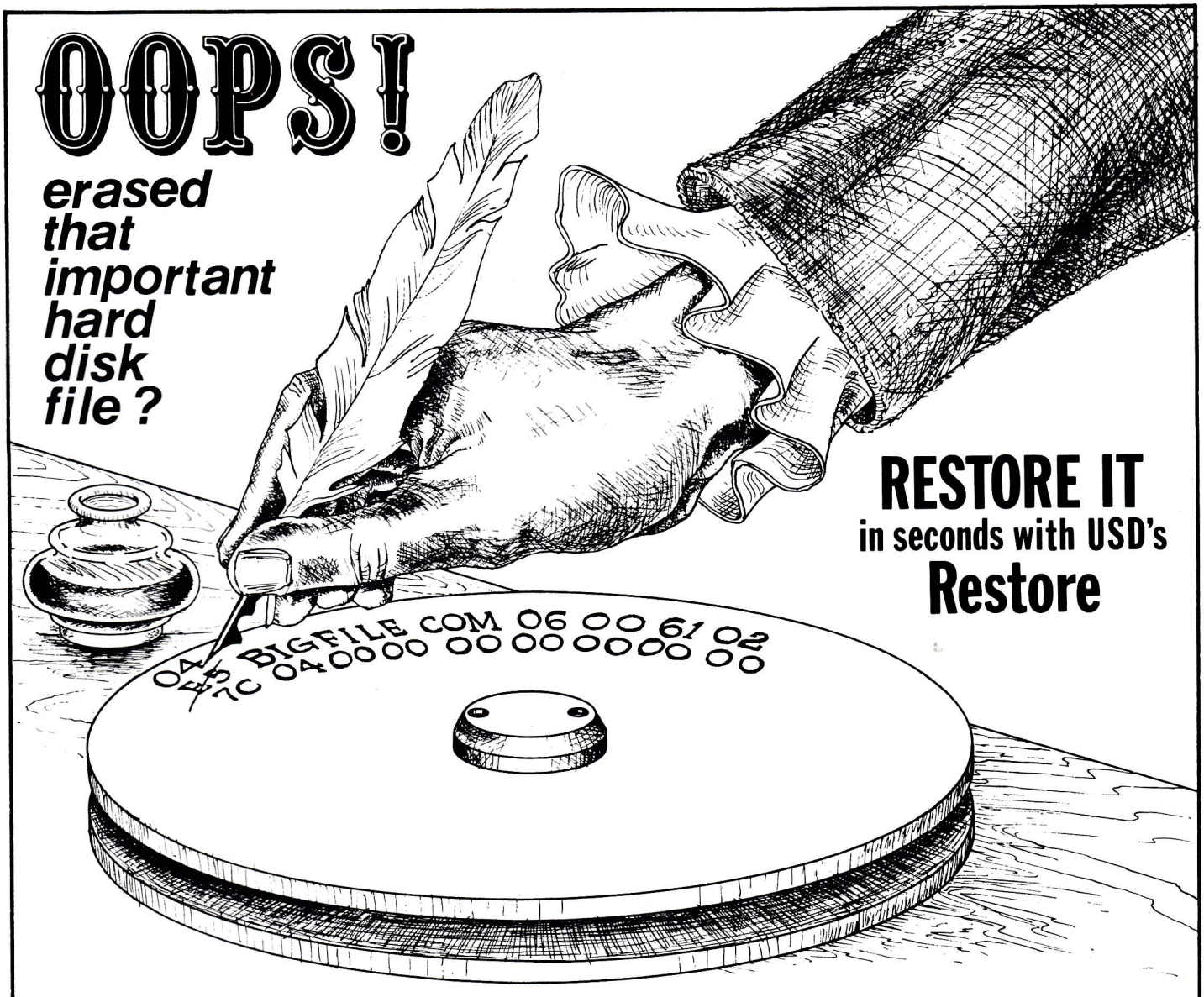
We received this note from Bill Purpura just as we were about to go to press:

> "Due to special constraints of our custom applications software used in an engineering environment, we are relegated to using CP/M. Our problem is that the CDOS Screen program will not operate under CP/M. We are in desperate need of a screen-type editor, with all the screen capabilities, that will operate under Intelligent Terminal Corporation's CP/M. Also, it must operate from a 3102 Terminal."

If anyone out there can help Bill, please let us know.

OOPS!

erased that important hard disk file?



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in seconds with USD's
Restore

WHAT YOU GET

Restore.Com and Edir.Com on SSSD 5¼ or 8 inch diskette, comprehensive Users Guide, one year's free software support.

WHAT IT DOES

Restore.Com restores erased files on Cromemco's hard disks (HDD-11, HDD-22, Z2-H, etc.) or any Cromemco floppy diskette.

Edir.Com displays an alphabetical directory of ERASED entries.

SYSTEM REQUIREMENTS

Cromemco computer operating under series 2 Cdos (version 2.xx).

WHAT IT COSTS

$95.00 For immediate air mail shipment.
New York residents add 7% — C.O.D. add 10%.
Make checks payable to U.S. Dynamics Corp.

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HOW TO ORDER

Call collect or write. If calling, place calls during normal business hours, EST. Ask for software sales.

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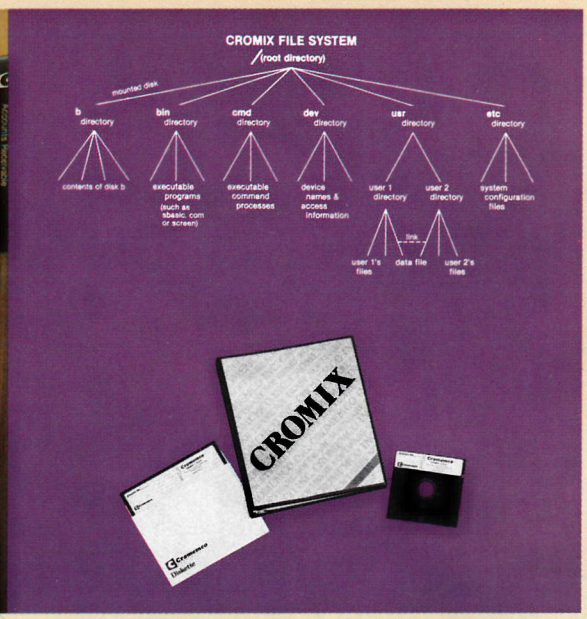

CROMIX*— Cromemco's outstanding UNIX†–like operating system

CROMIX is just the kind of major development you've come to expect from Cromemco. After all, we're already well-known for the most respected software in the microcomputer field.

And now we've come up with the industry's first UNIX-lookalike for microcomputers. It's a tried and proven operating system. It's available on both 5" and 8" diskettes for Cromemco systems with 128K or more of memory.

Here are just some of the features you get in this powerful Cromemco system:

- Multi-user and multi-tasking capability
- Hierarchical directories
- Completely compatible file, device, and interprocess I/O
- Extensive subsystem support

FILE SYSTEM

One of the important features of our CROMIX is its file system comprised of hierarchical directories. It's a tree structure of three types of files: data files, directories, and device files. File, device, and interprocess I/O are compatible among these file types (input and output may be redirected interchangeably from and to any source or destination).

The tree structure allows different directories to be maintained for different users or functions with no chance of conflict.

PROTECTED FILES

Because of the hierarchical structure of the file system, CROMIX maintains separate ownership of every file and directory. All files can thus be protected from access by other users of the system. In fact, each file is protected by **four separate access privileges** in each of the three user categories.

TREMENDOUS ADDRESS SPACE, FAST ACCESS

The flexible file system and generalized disk structure of CROMIX give a disk address space in excess of one gigabyte per volume — file size is limited only by available disk capacity.

Speed of access to disk files has also been optimized. Average access speeds far surpass any yet implemented on microcomputers.

'C' COMPILER AVAILABLE, TOO

Cromemco offers a wide range of languages that operate under CROMIX. These include a high-level command process language and extensive subsystem support such as COBOL, FORTRAN IV, RATFOR, LISP, and 32K and 16K BASICs.

There is even our highly-acclaimed 'C' compiler which allows a programmer fingertip access to CROMIX system calls.

THE STANDARD O-S FOR THE FUTURE

The power and breadth of its features make CROMIX the standard for the next generation of microcomputer operating systems.

And yet it is available for a surprisingly low $595.

The thing to do is to get all this capability working for you now. Get in touch with your Cromemco rep today.

*CROMIX is a trademark of Cromemco, Inc.
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